# COAL AGE

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DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

SYDNEY A. HALE, *Editor*

November, 1936

## Ancient Failures

TOO MANY coal men cling tenaciously to mining methods long employed simply because at some time a newer system made a conspicuous failure at a neighboring operation. The fact that technique, understanding and equipment all have been improved during the intervening years or that the installation may have been illy adapted to the particular conditions under which it was employed is dismissed without consideration. "It was a failure at Bill Smith's mine; why should I try it?" But progressive management in all fields is constantly learning that it is not wise to base decisions on future practice on conditions which no longer exist or, if they exist, can be surmounted. Management that thinks otherwise is in increasing danger of being crowded off the highway to profits.

## Do They Know?

OPERATORS' WAGE COMMITTEES seldom get busy until just before a new agreement is to be negotiated: then they debate the scale with representatives of the miners who have the pressure of the mine workers behind them and who are largely bound by the wishes of the rank and file. It is useless to argue with these spokesmen, not because they are willful, irresponsible or illogical men but because as representatives they have to be guided by the sentiment of their clients, to whom the arguments are not addressed. They may appear unconvinced because they dare not go back with defeat or even with a victory that seems like defeat.

Management apprehensive of the effects of further wage-increase demands should start their educational campaigns early by showing how coal is displaced by other fuels and how economies are being made in the use of coal because of its cost; what a large proportion of the cost is in labor and how production and consumption testify to these market changes. These facts should be on every mine bulletin board long before the mine workers make up their minds as to what instructions to give their representatives, so that informed opinion, not wishful thinking, shall direct their deliberations. Such bulletins should be illustrated and unburdened with excessive detail or technicality.

That final victory is not to the swift but to the patient was demonstrated several years ago in the union abandonment of the Jacksonville scale. Pressure for this action came from union officials in Illinois. But that pressure did not manifest itself until after a long educational campaign in which the Illinois producers directly and openly carried the facts of the situation to the rank and file. When the mine workers themselves finally became convinced that further maintenance of that scale was disastrous to their own welfare in Illinois, action followed.

## Abetting Competition

ANY HOPE that the railroads of the country would except solid fuels from their proposals to retain expiring emergency surcharges through permanent increases in rates has been dissipated. Speaking for the traffic executives' committee at Washington last month, D. T. Lawrence, chairman of that committee, specifically included coal and coke, as well as fuel oil, in the list of commodities upon which higher tariffs would be filed. The proposed advances on coal and coke range from 3 cents per ton where the base rate is 75 cents or less to 15 cents when the rate exceeds $2.

Superficially these may seem quite modest increases—less, in most instances, than those proposed on fuel oil. Actually, however, they would

further weaken the competitive position of coal and divert more business to rival fuels and rival forms of transportation. Pipe lines, of course, play a large part in oil movement and charges for such carriage are not affected by the railroad proposals. Truck competition in recent years has taken an increasing share of the coal tonnage; water-borne traffic also has been growing.

That some of these diversions of tonnage from the steam railroads are unsound cannot be denied. How much of the diverted traffic properly falls into that category is open to debate. But there is no gainsaying the fact that any increase, however modest, in rail charges will widen the field for the economic utilization of other methods of transportation. Railroad management admits this—but insists on abetting competition by its rivals. How else can the present proposals be explained?

## Water Tunnels

GRADIENTS of rivers are so easy that no construction engineer can hope to design a water tunnel paralleling them and obtain thereby a means of increasing the area under gravity drainage. Tunnels which parallel rivers have value only as intercepting watercourses. They, with advantage, can gather water together for its discharge into other tunnels which are broken away at occasional intervals at right angles to the flow of the streams. Only where the natural water channels may be described as brooks or runs is the fall greater than will suffice for a water tunnel. One of the flattest of such artificial waterways is the Honey Brook tunnel at Audenried, Pa., 0.17 per cent, or 8.976 ft. per mile, a gradient that would be steep for a river or creek.

To obtain an idea of the limitations of water tunnels one has only to imagine that wildest of wild dreams: a tunnel constructed from the anthracite region to tidewater at Newark, N. J., a distance of about 90 miles. So little does the Susquehanna River rise from tidewater to Wilkes-Barre along its curved and, in places, turbulent course to tidewater at a far more distant point that a tunnel with the Honey Brook gradient would be one and one-half times as high as the Susquehanna at Wilkes-Barre, and in the neighborhood of 808 ft.

All of which is not tantamount to saying that some anthracite mines well up on the slopes of the Northern Basin would not be bettered by tunnels driven at right angles to the valleys of the Lackawanna and Susquehanna rivers. Such drainages would take off the heavier inflows of water and cut the lift of other deeper and lesser influxes considerably. Distances would be short and the loss in tunnel gradient small. Much of the coal, especially below Wilkes-Barre, is, of course, well below sea level and must be pumped with all that between tidewater and, say, 525 ft. above it.

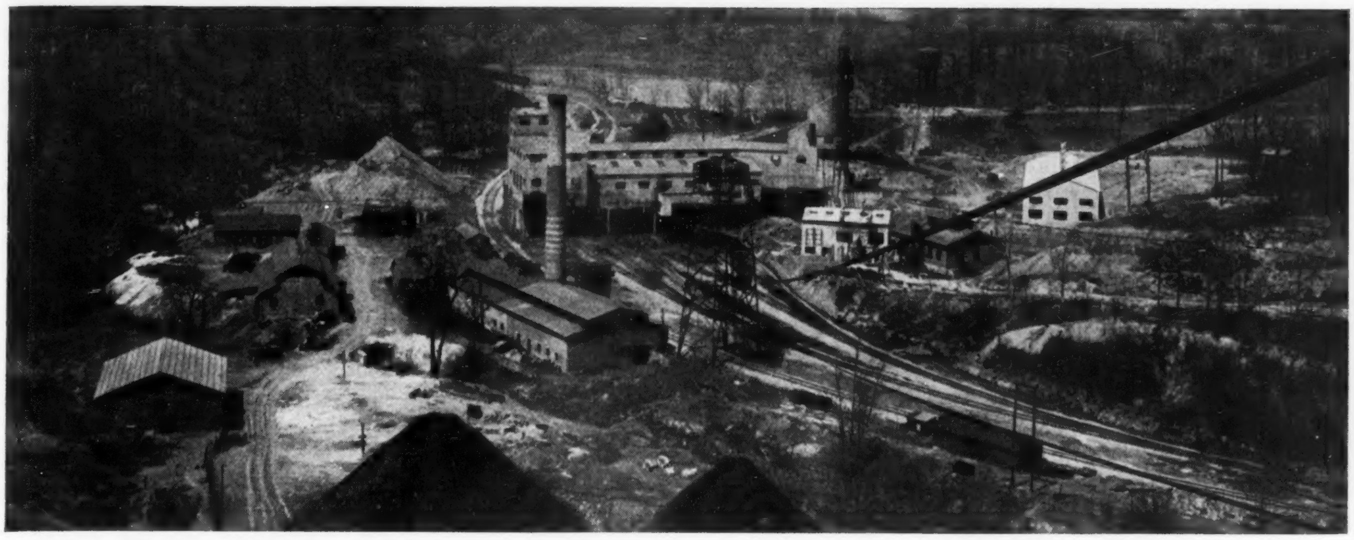
## Efficiency Yardsticks

ONE of the most common obsessions is the idea that there is an inevitable relationship between efficiency and size. Because some large units deservedly have won a reputation for efficiency and some small plants cling to outmoded methods, it is contended that large companies necessarily are efficient and small ones inefficient. Any real study of industrial organizations, however, shows the fallacy of such a broad generalization. Efficiency is not a question of size but of management and vision. That progressive small operations quite frequently expand and swallow up the business of their less efficient neighbors is another story.

## Safety in Politics

THE SPECTACLE of State mine inspection forces changing with a change in political administration is not a pretty one to those who want to improve the safety record of the industry. Tenure of office should be dependent upon ability to handle the job—not upon political faith or the uncertain favor of either operators or labor groups. That many inspectors have risen above such humiliating handicaps is a tribute to their devotion to the cause of accident prevention; it is no credit to a disgraceful system of political control.

Complete escape from this system, as Eugene McAuliffe (*Coal Age*, Vol. 41, p. 477) and others have emphasized, can come only through the appointment of technically trained and qualified men, protected by civil service and removable only for good cause shown. And lack of consideration for the sensibilities of operators or miners winking at or indulging in unsafe practices would not be a "good cause." Until the civil service idea is generally adopted we shall continue to take an unfair advantage of the competent and conscientious inspector.



On the site of two previous operations, the new Talleydale plant mines and ships coal from the Indiana No. 3 seam.

# COMPLETE MECHANIZATION

## + Marks Resumption of Operations On Old Talleydale Property

By IVAN A. GIVEN

*Associate Editor, Coal Age*

INFUSION of new life into an old mining property marked the taking over of the Talleydale mine, ten miles northwest of Terre Haute, Ind., by the Snow Hill Coal Corporation on Oct. 1, 1934. Initiating a new production cycle on the property, where the upper seams already had been mined, the new company since that date has constructed a complete mining plant with a maximum capacity of 3,500 tons per day to recover, prepare and ship the Indiana No. 3 seam. Where the previous operations depended upon hand loading and hand picking for production and preparation, the new Talleydale relies on mechanical loaders, washers, dedusters and air cleaners for mining and cleaning the output.

The No. 3 seam is the lowest of the four seams worked on the property, lying 341 ft. below the collar of the new shaft. The highest, or Indiana No. 6, 6½ ft. thick, lies 26 ft. below the collar, but was mined by a number of small operators at other locations. The Indiana No. 5 seam, 5 ft. thick and 175 ft. below the collar, and the Indiana No. 4, also 5 ft. and 294 ft. down, were mined from shafts sunk within 300 ft. of the present opening.

In starting work in the No. 3 seam, the present company took over from the Talley Coal Co., original operator of the Talleydale mine, which opened up the bed from a shaft extended down from the No. 4 seam in 1931. This shaft was cleaned out and now serves as the air shaft for the new operation. The No. 5 seam also was mined by the Talley interests from a separate shaft, the mine bearing the name of the operating organization: the Clovelly Coal Co.

Thickness of the No. 3 seam is 5 to 6½ ft. Average dip, excluding local variations, is 7 ft. per mile to the southwest. The seam is characterized by two persistent partings, as well as a number of local partings and pyrites in the form of grains and lenses scattered throughout the coal. The major persistent parting, varying from 1 to 1½ in. in thickness, occurs 24 to 30 in. above the floor and ranges in character from almost pure pyrites to hard shale. The second parting, mostly of pyrites and of knife-blade thickness, occurs 15 to 18 in. above the bottom. Presence of these partings and other impurities was the major factor in the installation of mechanical cleaning facilities on the surface, thus assuring maximum production from loading machines through relieving crews of the cleaning duty, as well as shipment of a clean product, particularly in the finer sizes, as compared with hand-picking, which at its best could give only fair results in the larger sizes, with no improvement in the fines. (A complete description of the Snow Hill plant is the subject of an article appearing on p. 500 of this issue.)

Underneath the No. 3 coal at Talleydale is a hard fireclay which, however, disintegrates upon exposure to the air for any length of time. Immediately over the coal is a hard gray shale varying from 1 to 5 or 6 ft. in thickness, and overlaid by laminated sandstone and sandy shale about 6 ft. thick. Careful timbering is a necessity, as the roof is subject not only to deterioration from changes in temperature between day and night and winter and summer but also is characterized by planes of weakness, known locally as "cutters," running generally north and south. Unless caught by timbers, breaks along the lines of the cutters, which occur soon after the coal is removed, continue up into the overlying measures indefinitely. In view of the nature of the roof, room depth so far has been limited to 250 ft.

as a rule and room directions to east and west. Also, to minimize the effects of temperature changes, ventilating air is conditioned as described in succeeding paragraphs.

In developing the No. 3 seam, the main entries were placed directly under the mains in the No. 4 seam by the Talley Coal Co., which sunk its hoisting shaft and constructed its bottom about 250 ft. to the south. The new hoisting shaft was sunk by the Snow Hill organization to strike directly into one of the headings in the four making up the east and west main entries, on which the bottom is established. The property is roughly rectangular in shape and is approximately 3 miles long (east and west) and $1\frac{1}{4}$ miles wide (north and south) with the easterly boundary in the center of the Wabash River. The new shaft is slightly south of the east-west center line and about 1 mile west of the river. Reserves of No. 3 coal are estimated to be sufficient for 25 to 35 years of operation. Maximum depth of cover is approximately 425 ft.

Depth of the new shaft from collar to the top of the No. 3 seam is 341 ft. Two hoisting compartments and pipe and cable compartment are provided. Over-all dimensions inside the lining are 21 ft. 3 in. x 13 ft. 9 in. Hoisting compartments have a clear width inside buntons and lining of 19 ft. 1 in.; clear width of the pipe and cable compartment is 1 ft. A concrete lining down to the solid rock below the No. 6 seam is provided, and the shaft also is concreted through the old workings in the No. 5 seam, through the main entry in the No. 4 seam and above and below the No. 3 seam. Elsewhere, the shaft is timbered with untreated fir. Guides are made of 100-lb. steel rails.

In preparing for the new shaft it was found necessary to dewater the No. 4 workings, which had filled from breaks into the Wabash Valley gravel in which the river channel is cut, and also to provide facilities for pumping the seam from time to time. The No. 5 workings, investigation showed, are dry. To handle the No. 4 water, two 350-g.p.m. centrifugal pumps were set in the Old Bardyke shaft, another Talley operation, to the northwest, the low point in the No. 4 workings in the region. With preliminary dewatering completed, these pumps are run two or three days approximately every two weeks to remove accumulations. Entrance of water into the new shaft from the No. 4 seam—or from the No. 5 if it should become wet

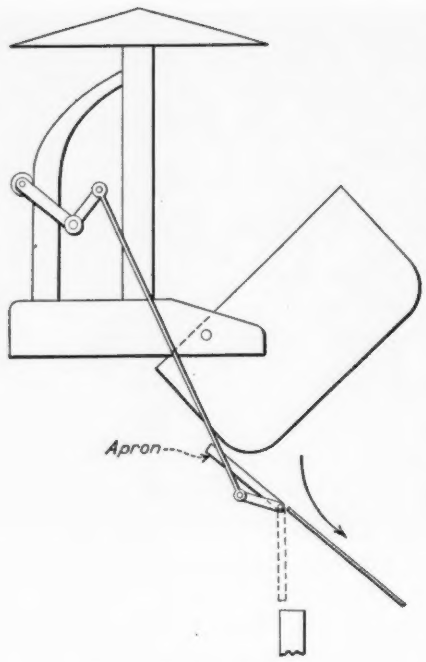



**Fig. 1—Diagrammatic sketch showing operation of apron in dumping operations.**

in the future—is prevented by the concreting noted above.

Talleydale cars are of the solid-end type and consequently Allen & Garcia overturning cages weighing approximately 22,000 lb. each were installed. To prevent spillage of coal down the shaft during the dumping cycle, an apron is installed in front of the dumping shield in each compartment. As the cage comes to the dumping position, it engages an arm which swings the apron out and up into position to catch the coal (Fig. 1).

To minimize damage to cages and guides arising out of checking the heavy loads ($7\frac{3}{4}$ to 8 tons) to be caged, the two dogs on each cage are mounted on a movable shaft located along the center line of the cage beneath the floor. When the loaded car strikes the stopping dog, the shaft is thrust forward against a spring buffer mounted in the wall of the sump. This buffer absorbs the caging shock. An auxiliary spring on the cage returns the shaft to its normal position after the car rebounds against the second, or holding, dog. Shoes on the sides of the cars engage dumping rails on the cage to hold the car in position during the dumping cycle.

Cars are hoisted by a Hardie-Tynes hoist with a double cylindro-conical drum. Diameter of the small cylinders on either end is 8 ft.; diameter of the large center cylinder common to both ropes is 10 ft. Two turns are required to carry the $1\frac{5}{8}$-in. rope up from the small to the large cylinder. The hoist is powered by an Allis-Chalmers 700-hp. 514-r.p.m. 2,300-volt phase-wound a.c. motor with a pull-out torque of 1,800 hp. From $5\frac{1}{4}$ to $5\frac{1}{2}$ tons of coal is hoisted per trip in 5,000-lb. cars, and the normal hoisting cycle is 30 seconds, as follows: caging, 6 seconds; acceleration, 6 seconds; running, constant speed (1,340 f.p.m.), 12 seconds; deceleration, 6 seconds. Hoisting distance from the bottom landing to the dumping point is 397 ft.

Unusually short double tracks for empties and loads and extreme simplification mark the bottom layout at Talleydale. The necessary double-tracking was kept as low as possible because of the expense involved in roof protection. Also, it was felt, storage space could just as easily be obtained by using the single main-line track in the haulage heading, with run-around tracks, necessary in any case, in adjacent headings. Consequently, double-tracking on the loaded side was limited to a length of 180 ft., providing space for 28 or 30 cars. Fifty feet of double track was installed on the empty side, accommodating six to eight cars on the two tracks. Gravity operation has been the rule on the bottom to date with two men on the loaded and one on the empty side, but automatic caging is under consideration.

Because of the extremely bad character of the roof, the Talleydale bottom was timbered with 12-in. I-beams. I-beam span is 17 ft. 9 in. Centers are 37 in., the ends of the I-beams resting on concrete walls. To afford complete protection against material falling out through the I-beams, the spaces then were filled with precast concrete arches (Fig. 3). After the arches were placed, the ends were grouted where they came in contact with the beams. On test, the arches withstood a load of 10,500 lb. placed along the center line. Cost was $1 each. Forms were made and the casting was done at the mine. No. 14 steel wire with a 2-in. mesh was used as reinforcing, primarily to reduce breakage in handling.

As indicated above, the main development entries, running east and west from the shaft bottom, consist of two intake headings 12 ft. wide on 30-ft. centers and two return headings of the same width and on the same centers.

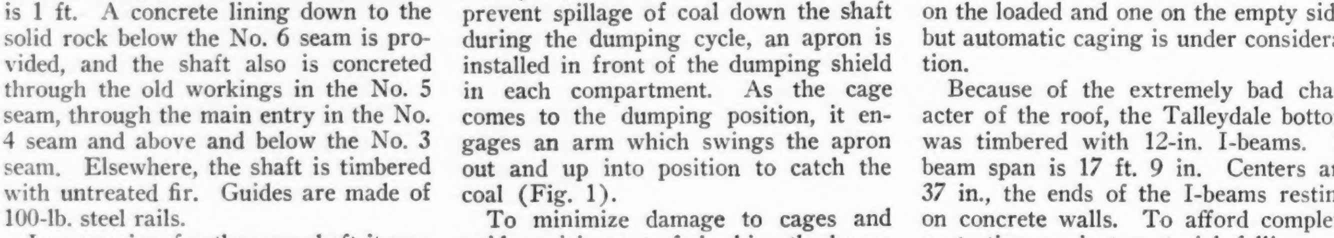



**Fig. 2—Bottom layout, No. 3 seam, Talleydale mine.**

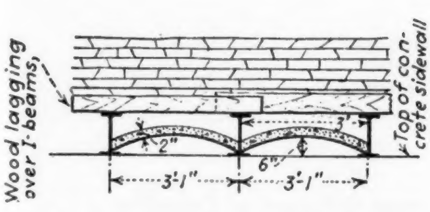



**Fig. 3—To stop falling material, precast concrete arches are installed between I-beams on the shaft bottom.**

Intake and return heading groups are separated by chain pillars 38 ft. thick, made by increasing the center-to-center distance between the inside intake and the inside return headings to 50 ft. Coal to the north and south is reached by north and south main entries at right angles to the east and west mains. Originally, these north and south mains were made up of four headings driven on the same system as the east and west mains and placed directly under the corresponding mains in the No. 4 seam. In anticipation of eventual operation in coal not overlaid by No. 4 seam workings, the company is experimenting with a system under which the north and south mains are reduced to three headings to the first cross entry and thereafter to two headings, one serving as the intake and haulage road and the other as the return.

Panel entries are turned at right angles off the east and west mains or off cross entries between the north and south mains. In other words, panel entries parallel the north and south mains, which throws the rooms, turned at right angles, east and west, or at right angles to the cutters referred to above. Experiments have been conducted with rooms turned at a 45-deg. angle to facilitate haulage, retaining the same distance between panel entries, but results so far indicate that in general the increased time required to work them out, due to the increased depth, results in a marked increase in troubles from deterioration of the roof.

Room panels consist of 40 rooms 22 ft. wide on 45-ft. centers (Fig. 4). Panel entries consist of two headings 12 ft. wide on 50-ft. centers. Twenty of the rooms are turned off one of the two headings and twenty off the other. Solid pillars surround the panels on three sides, with the two headings as the only openings on the fourth. Room depth normally is 250 ft., as greater distances mean in general an excessive deterioration of the roof and consequent difficulty in completing operations in the place. Even with a depth of 250 ft., it generally is necessary to go over the timbering in the first half of the room and install crossbars to supplement the posts normally set along the roadway as the place advances (Fig. 5). At present, following out the scheme of development in the No. 4 seam above, north and south mains are spaced to allow three room panels to be driven between them. Later, the number may be increased.

Loading at Talleydale has been mechanized with track-mounted equipment. At present, four Goodman 260-A and two Jeffrey 44-D machines are in use. Additional units will be added to bring the daily output to the designed figure. Each loading machine is accompanied by a 6-ton General Electric cable-reel locomotive. Experiments are now under way to ascertain whether a sufficient increase in tonnage can be secured to warrant two locomotives per loading machine. A Chicago Pneumatic 470 portable electric coal drill also is included in each loading unit. Cutting is done by four Goodman track-mounted machines, two with 8- and two with 9-ft. cutter bars. Two of the Goodman loaders are engaged in development work (see below) and consequently two of the cutters are used on the day shift in these sections. Then, on the night shift, all four cutters are put to work in room territories.

**Table I—Constitution of Loading Crews in Development and Room Work, Talleydale Mine**

| Classification | Goodman, Development | Goodman, Rooms | Jeffrey, Rooms |
|---|---|---|---|
| Foremen (salary) | 1 | ½ | ½ |
| Loader operators ($7.45) | 1 | 1 | 1 |
| Helpers ($7.45) | 1 | 1 | 2 |
| Cutters ($7.45) | 2 | 2 | 2 |
| Drillers ($6.85) | 1 | 1 | 1 |
| Bugdusters ($5.07½) | 1 | 1 | 1 |
| Motormen ($5.64) | 1 | 1 | 1 |
| Tripriders ($5.07½) | 1 | 1 | 1 |
| Trackmen ($5.07½) | 3 (a) | 2 | 2 |
| Timbermen ($5.07½) | 2 (b) | 2 | 2 |
| Snubbers ($5.07½) | 1 (c) | 1 (c) | 1 (c) |

(a) Third trackmen on development crews engaged primarily in laying switches; also may be employed setting timbers.

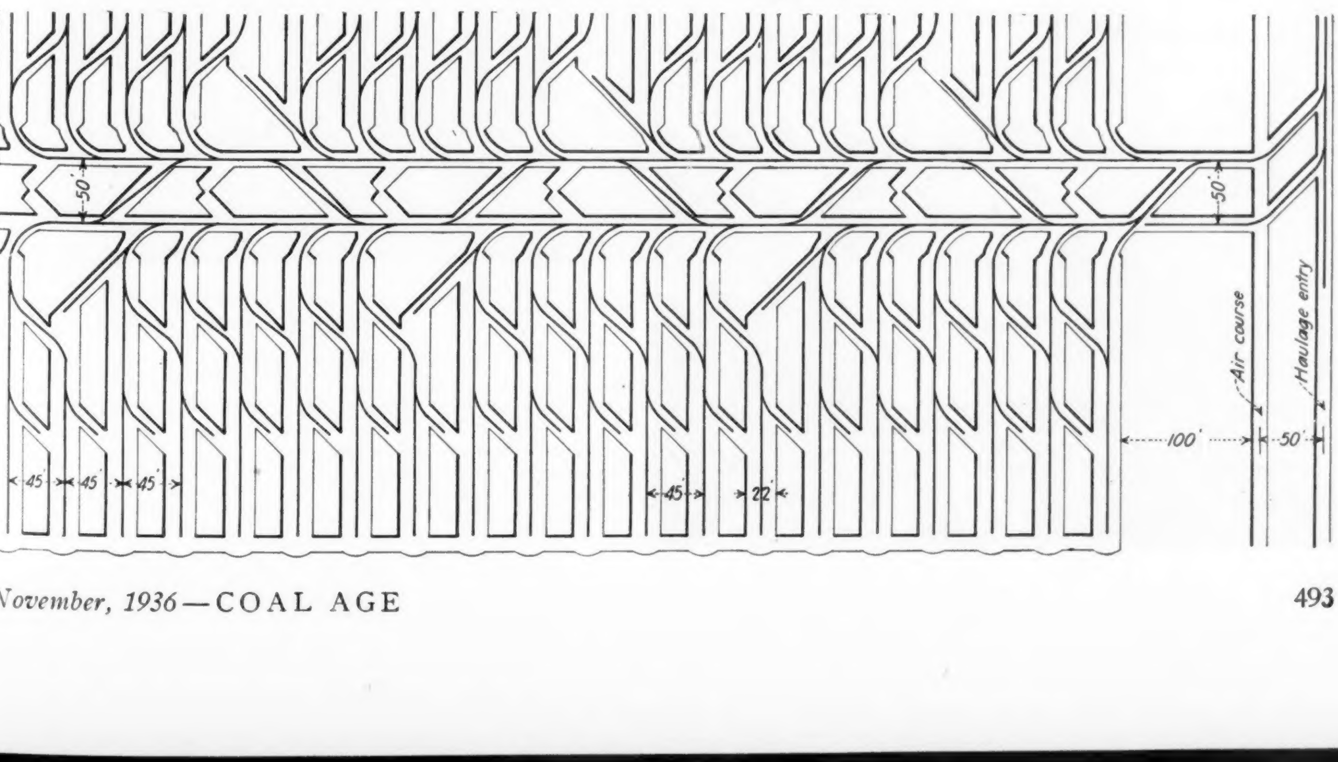
(b) Extra timbering sometimes requires one or two extra men per shift.

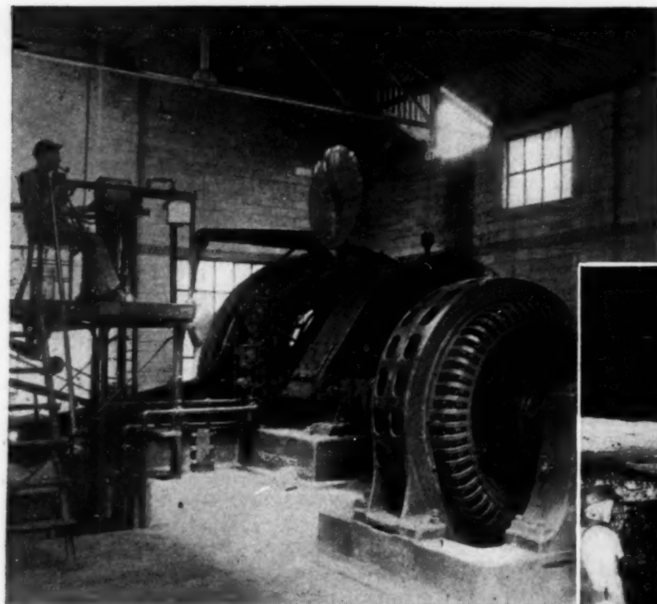
(c) Under normal conditions, snubbing for three sections is done by a crew of two men and a foreman.

Room units at present work in groups of two (one Goodman and one Jeffrey loader) per panel. Development work is arranged, where possible, to give each machine employed in this class of work an opportunity to increase its daily capacity. As each development machine normally has, in addition to other entry work, one or two groups of room panels, driving the headings and necking the rooms on the advance, it is customary to let these machines advance the first few or possibly half the rooms in a panel as far as possible before moving on. Entries, however, are the primary responsibility of the development machines, and each heading must be extended one cut each working day, after which the machines move into the rooms to increase their output.

Crews for the various types of loading machines normally are constituted as in Table I. As a Goodman and Jeffrey loader usually work together in a room panel, one foreman can oversee the operation of both without difficulty. Snubbing, done with the loading machines at Talleydale, is performed by crews of two men and a leader each, and each crew snubs for three sections.

**Fig. 4—Talleydale room panel showing track location.**





Cars are brought to surface by double cylindro-conical-drum hoist driven by a 700-hp. motor

One of the types of loaders at Talleydale starting in on a fresh cut.

Track-mounted bottom cutters undermine the coal. The persistent No. 3 parting appears just above the bottom.

Second type of Talleydale loader working into a cut.

Mine cars ready to go on the cage. The bottom is protected by steel I-beams and concrete arches on concrete walls.

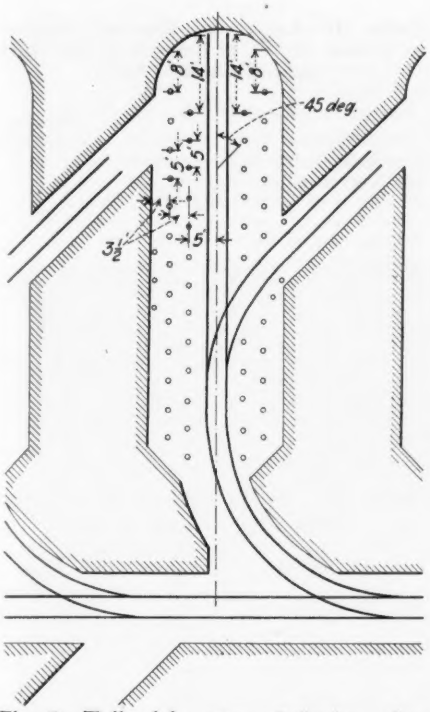



**Fig. 5—Talleydale room timbering plan. By the time a room reaches its full depth, it generally is necessary to supplement the posts with crossbars in the outbye half.**

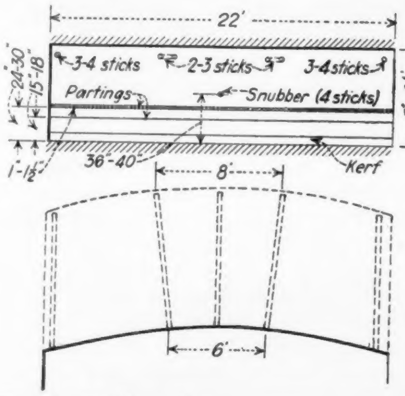



**Fig. 6—Drilling plan in rooms at Talleydale mine, with number of sticks of explosive usually loaded in each hole. The snubbing shot is fired first and the coal loaded, after which the top holes are fired. In entries, only three top holes are drilled.**

Loading, face preparation and other activities at Talleydale are spread over three shifts. Actual loading operations are confined to the first shift, and loading crews are expected to clean up in each place before leaving. Next, the timbering is extended in accordance with the plan given in Fig. 5. To give maximum protection with a minimum of interference with loader and cutter operation, the V system of timbering is employed in rooms. Normally, two rows of posts are set on each side of the track, supplemented, as indicated above, by crossbars over the track when roof conditions warrant them. Upon completion of timbering, the track is extended. In room sections, this completes operations on the first shift. In development sections, on the other hand, undercutting, the next activity, may take place on either the first or second shift.

Operations on the second shift are confined to undercutting, with the exception of the development sections indicated above, bugdusting and drilling. Snubbing is the first operation on the third shift. The snubbing hole (Fig. 6) is drilled in the center of the place 36 to 40 in. above the bottom, or just sufficient to clear the loader head, which requires about 30 in. of height. Four sticks of Monobel No. 11 are loaded in the snubbing hole as a rule and are shot with electric detonators. The snubbing shot breaks down the bands in the lower part of the seam and when loaded out gives a large free space into which the coal from the top holes can fall. After shooting the snubbing shot, a Goodman loader is brought into the place and one car of coal is loaded out. Use of the loader, it is felt, reduces the time and labor required for effective snubbing by other means and the coal is loaded directly into a car—the most efficient method of disposal.

After snubbing, the top holes, located as in Fig. 6, are loaded and shot, whereupon the place is ready for loading on the first shift on the next working day. Entries are cut, snubbed and shot in substantially the same manner as the rooms, except that three instead of four top holes are used. Drillers are provided with push trucks for transporting drills and equipment from place to place. Trucks are equipped with reels and plug connections for obtaining power for drill operation.

To reduce the number of car changes and thereby increase effective loading time, 5-ton all-steel cars weighing 4,950 lb. and equipped with Timken roller-bearing wheels are employed. Mechanically loaded, these cars average 5¼ to 5½ tons. Designed by Allen & Garcia and built by the Marion Steam Shovel Co., the cars (Fig. 7) are characterized by six internal stiffeners on the sides and ends to fit them for mechanical loading, A. & G. semi-automatic couplers providing both spring draft and buff, and Bonney-Floyd individual wheel units. In the case of the couplers, the pin can be cocked in position, where it is held by friction. The jar when the next car is bumped up causes the pin to fall down through the link, coupling the cars together without further attention from the triprider. The wheel units provide a spring mounting for the body of the car. Each unit consists of the wheel, axle and spring mounted in a preformed steel-plate shroud riveted in the car bottom. As each wheel assembly is a separate unit, it can be installed or removed without affecting the other units on the car.

Car-changing methods are based on maintaining a maximum changing distance of not over 100 to 125 ft., where possible. For greater distances, it has proved more economical to install a switch and changing track, as time studies have shown that by limiting the distance to 100 to 125 ft. changing time can be held within one minute as an average. Lengthening changing distance to 200 ft., on the other hand, increases changing time to nearly two minutes. Consequently, room tracks are connected through the first crosscuts and changing switches are laid in the next crosscuts (Fig. 4).

After loading out the snubbing shot, six to seven cars usually remain in a place for the regular day-shift crew. In serving the loader, the 6-ton locomotive heads in a trip of three or four cars. As soon as the front car is loaded, the trip is pulled out and the load is placed on the nearest changing track, whether it be on the entry or in a crosscut. When the trip is completely loaded, if not already on the entry or other storage space where trolley wire is strung, it is pulled out to such storage space and

**Table II—Men Employed Underground and Output on Sept. 11, 1936, Talleydale Mine; Seven Loading Machines in Operation**

| Occupation | Loading Crews | General Crew Day Shift | General Crew Night Shift | Maintenance | Total |
|---|---|---|---|---|---|
| Mine foremen | — | 1 | — | — | 1 |
| Night foremen | — | — | 2 | — | 2 |
| Face foremen | 4 | — | — | — | 4 |
| Loading machinemen | 16 | — | — | — | 16 |
| Cutting machinemen | 12 | — | — | — | 12 |
| Drillers | 7 | — | — | — | 7 |
| Bugdusters | 7 | — | — | — | 7 |
| Shotfirers | — | — | 4 | — | 4 |
| Motormen | 7 | 4 | 3 | — | 14 |
| Tripriders | 7 | 4 | — | — | 11 |
| Cagers | — | 1 | — | — | 1 |
| Couplers | — | 2 | — | — | 2 |
| Tracklayers | 18 | — | 2 | — | 20 |
| Timbermen | 19 | — | 2 | — | 21 |
| Pumpmen | — | 1 | — | — | 1 |
| Firebosses | — | 1 | — | — | 1 |
| Bratticemen | — | 1 | — | — | 1 |
| Seals | — | 3 | — | — | 3 |
| Deadwork underground | — | — | 6 | — | 6 |
| Electricians | — | — | — | 10 | 10 |
| Total | 97 | 18 | 19 | 10 | 144 |

| | |
|---|---|
| Total employees underground | 144 |
| Mine cars loaded | 477 |
| Tons washed coal loaded | 2,268* |

* Washed coal loadings represent approximately 85 per cent of the material hoisted.

another trip of empties is brought in to complete loading in the place. Ten-ton trolley-type locomotives operate between these storage spaces and the bottom, bringing in empty trips and taking out the loads.

With the exception of the east-west and north-south main headings, laid with 60-lb. rail, track construction is based on the use of 40-lb. rail on steel ties with steel-tie turnouts. This construction is standard for cross entries, panel entries and rooms. Steel ties employed have a weight of 3¼ lb. per foot. The steel-tie turnouts, as a general rule, are laid with No. 2½ all-welded frogs constructed in the mine shop (p. 517 of this issue), four special ties and spring-type parallel throws. The four special ties go under the switches, and two are extended out to the right or left far enough to accommodate the throw. Standard ties are used elsewhere in constructing the turnout, including under the frog. Among the advantages of the turnouts are speed of laying, positive switch action and easy operation of rolling stock, including elimination of

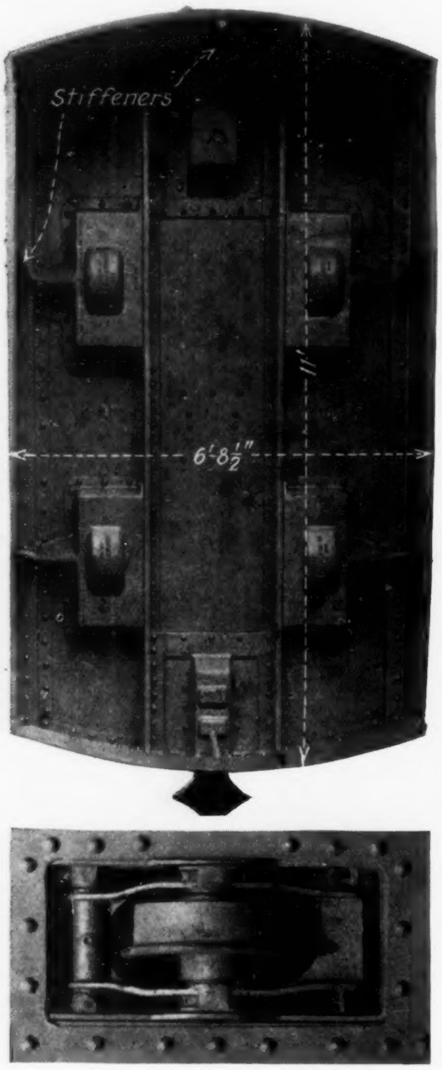



Fig. 7—Above, inside view of Talleydale mine car; below, individual wheel unit. Height of car above the rails is 42 in.

sudden changes in rail elevation which would be necessary in case the turnout, or switches or frog alone, were laid on wood ties. Sufficient stiffness is provided by the rail weight of 40 lb. to resist satisfactorily the stresses growing out of normal equipment movement. One trackman, as a rule, can lay a steel-tie turnout in two hours.

Main-haulage roads on east-west and north-south mains are laid with 60-lb. rail on 5x7-in. creosoted ties 6 ft. long. Track gage is 42 in. Ties are spaced 30 in. apart and gravel ballast is employed. Standards call for a minimum clearance of 30 in. from the side of the car on the left-hand side of the track. Trolley wire, feeders, cables and signal and telephone wires are suspended from the roof or from the crossbars on the right-hand side. At crossings and other places where men customarily pass under the trolley wire, it is protected by United States Rubber Co. flexible-rubber guarding. This guarding, preformed in the shape of an angle, is suspended from the hangers.

Main entries are protected by 60- or 70-lb. steel-rail crossbars on 5-ft. centers resting on 10- to 20-ft. stringers laid on pins concreted in hitch holes drilled in the ribs. Other entries generally are protected by steel-rail crossbars resting on timber legs, although some pin-and-stringer construction is used where roof conditions are worse than usual. In using the hitch drill on main entries, it generally is necessary to set temporary timbers while drilling the hitch holes, setting the pins and stringers and installing the crossbars to guard against unexpected falls. Pinholes usually are drilled 4½ to 5 ft. deep to accommodate 5½- to 6-ft. pins, which are wedged in place and then concreted for permanency. Crossbars are lagged over the top from rib to rib throughout the entire length of the entry.

In some instances where the usual hitch pin is impractical because of abnormal weight or weakness of the rib and where clearances prevent the use of posts the shoulder brace shown in Fig. 8 is employed. Instead of one hitch hole, two are drilled, one over the other. The shoulder, made of 70-lb. rail bent and welded as shown, is concreted in the hitch holes. In some cases, where the falls had extended up considerable distances over the crossbars, the idea shown in Fig. 9 was employed. The usual crossbars are hitched into the top of the seam and, instead of filling the open spaces above them with wood cribbing or lagging, a frame of welded-rail sections was erected. In constructing the frame, a series of columns spaced to rest on the crossbars is welded to the top bar. The columns distribute the weight over several crossbars. The space over the top of the frame is filled with lagging, which is greatly reduced in quantity. Another advantage as compared with the sole use of lagging or cribbing is greater permanency.

**Table III—Labor and Material Required to Timber 100 Ft. of Entry With the Hitch Drill, Talleydale Mine**

*Labor*

| Description | Number Man-Shifts |
|---|---|
| Temporary timbering | 2 |
| Drilling pinholes | 2 |
| Setting and concreting pins in holes | 3 |
| Setting stringers, crossbars and lagging over bars | 9 |
| Delivering material | 2 |
| Total | 20 |

*Material*

| No. | Description | Length, Each, Feet |
|---|---|---|
| 25 | Crossbars (60-lb. steel rail) | 12 |
| 12 | Stringers (60-lb. steel rail) | 14 |
| 36 | Pins (60-lb. steel rail) | 5 |
| 500 | Round lagging | 6 |

**Table IV—Power Consumption, Talleydale Mine, August, 1936**

| | Energy Consumption, Kw.-Hr. Total | Per Ton | Per Cent of Total |
|---|---|---|---|
| Water supply | 7,920 | 0.20 | 4.35 |
| Hoist | 27,800 | 0.71 | 15.24 |
| Preparation plant | 52,000 | 1.33 | 28.51 |
| Miscellaneous surface | 4,280 | 0.11 | 2.34 |
| Underground | 90,400 | 2.31 | 49.56 |
| Total | 182,400 | 4.66 | 100.00 |

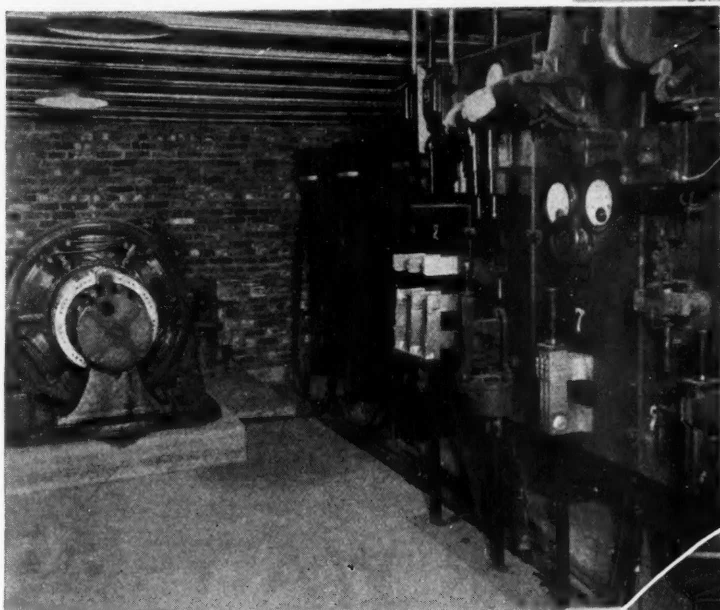
| | |
|---|---|
| Total shipments, tons | 39,187 |
| Days worked | 21 |

Power for the operation of Talleydale mine is purchased from the Public Service Co. of Indiana at 33,000 volts. Three 1,000-kva. transformers reduce the voltage to 2,300 before sending the current out to the various circuits, which at present are as follows: water supply, deep-well pumping station, hoisting, preparation plant, miscellaneous surface loads, and underground operation. A sixth major circuit will be the ventilating fan when installed. Pending installation of this fan, the mine is being ventilated by the steam-driven fan installed to supply air to the old Talleydale mine.

Incoming power is metered at 2,300 volts by a master meter; separate meters are installed to ascertain the consumption in the various subsidiary circuits. In the month of August, prior to the installation of the electrically driven fan, consumption by the various use classifications was as shown in Table IV. With the connection of the new fan into the system, consumption per ton is expected to rise to approximately 4.85 kw.-hr. Installation of additional loading machines and auxiliary equipment to bring the output up to the contemplated level of 3,500 tons per day will increase total energy consumption, but is expected to have little effect on energy use per ton.

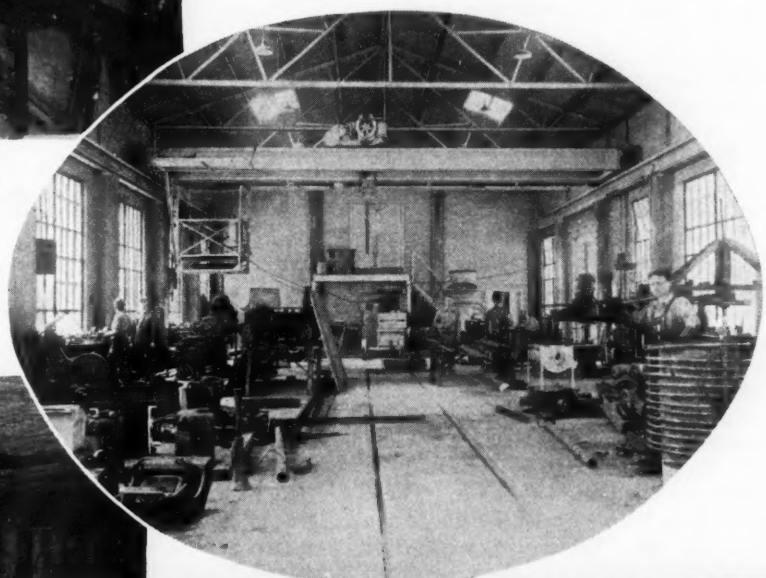
D.c. power for underground use is furnished by two 300-kw. rotary converters, both of which are installed back in the working sections. Each converter, with 2,300/440-volt transformers and switchboards, is mounted in a brick substation with concrete floor and steel-

A section of main-line track laid with 60-lb. rail on creosoted ties with gravel ballast. Protection against falls is provided by wood lagging resting on crossbars of 60-lb. rail, in turn supported on stringers resting on pins put in with the hitch drill.



Rotary converters with automatic controls in underground substations supply d.c. power for equipment operation.

The Talleydale shop is equipped for a wide range of repair and fabricating work. The parts store room is at the back.



Difficult roof conditions make systematic timbering necessary in rooms.

E. J. Weimer, general manager, looks over a steel-tie switch, standard for all 40-lb. track at Talleydale.

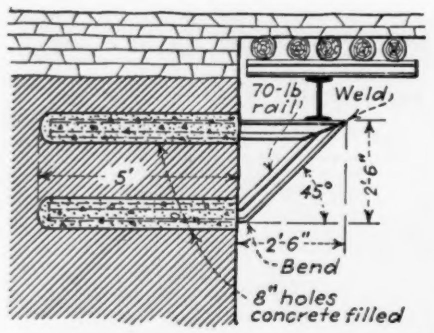



**Fig. 8—Shoulder brace used in timbering where roof loads are heavy.**

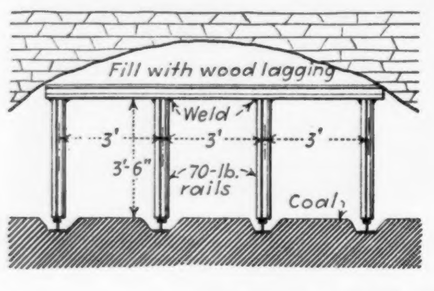



**Fig. 9—Details of roof support used where top has fallen to considerable height**

rail-and-corrugated-metal roof. Controls are fully automatic. A.c. power at 2,300 volts to operate the substations is taken down the shaft by a wire-armored cable with 400,000-circ.mil conductors. The cable is suspended in the shaft by its armor, and connects at the bottom into an oil switch which permits all power to the mine to be cut off when desired. From the oil switch, rubber-covered cables—three No. 2 wires—run back to the transformers in the substations. Trolley-wire size is 4/0 and it and the primary a.c. cables and other power circuits are suspended from the roof or crossbars by Ohio Brass fittings. The track is bonded for a return with "Erico" A.U.F. 7-in. 4/0 bonds. These bonds, of the welded type, lie under the base of the rail. When used with angle bars, the bars are cut to allow the bond to be welded to the base of the rail.

Surface equipment at Talleydale includes a 40x120-ft. shop and parts storeroom built of brick with corrugated-steel roof supported on structural-steel trusses. Equipped for armature winding, repair and welding work, the shop includes the necessary appliances for doing practically all of the rebuilding, electrical and mechanical repair, welding and fabricating necessary in mine operation. Only certain specialized jobs and unusually heavy work need be done outside. Talleydale surface equipment also includes a complete forging and heat-treating plant for mining-machine bits. Developed by James Hyslop, assistant to the vice-president, the heat-treating system is designed to provide oil-quenching of the sharpened bits at a uniform temperature supplemented by annealing, also at a predetermined uniform temperature, to toughen the bits and make them less subject to breakage under the difficult cutting conditions prevailing underground.

Dull bits are first heated in a Sullivan oil-fired furnace and then are sharpened in a Sullivan roller-type sharpener. After rolling, the bits are allowed to air-cool. Next, to insure a uniform temperature throughout and consequently make possible uniform hardening in quenching, the bits are heated to approximately 1,300 deg. F. From the furnace the bits drop into a basket submerged in about 50 gal. of quenching oil in a cylindrical tank. Cooling coils, through which water flows, keep the quenching oil at approximately 150 deg. F. When a sufficient number of bits have accumulated, the basket is lifted out of the quenching tank with a chain hoist and the oil is allowed to drain off. At this stage, the bits are hard and brittle and consequently are not in condition for use.

To fit the bits for service, they are next drawn in a bath of fusible salt in a tank 16 in. wide, 30 in. long and 16 in. deep. The salt used becomes fluid at about 275 deg. Heat is supplied by an oil burner. Bits to be tempered are placed in another basket fitting the tank and are immersed in the molten salt. When the cold bits are immersed, the temperature of the salt drops about 150 deg. The bits are allowed to soak, usually about 15 minutes, until the temperature rises to 500 deg., as indicated by a thermometer in the bath. The bits are then removed and allowed to air-cool, whereupon they are ready for use.

A Jeffrey "Aerodyne" fan has been installed to ventilate the Talleydale mine. It will be supplemented next summer by a mine-air conditioner on the discharge side to maintain a wet-bulb temperature of 60 deg. F. in the downcast air during the hottest days. Cooling will be done by water from the Wabash River valley gravel, supplied by the same deep-well pump that serves the preparation plant. Average temperature of the water is 56 deg., and on the hottest days the requirements will aggregate about 600 g.p.m.

# ACID RIVER WATER

## + Neutralized and Clarified Inexpensively for Breaker Use

HOW to utilize inexpensively a source of water which runs about 40 per cent solids was a problem presented the Kehoe-Berge Coal Co., Pittston, Pa., when it found the water it was pumping from the William A Shaft was too acid for its purpose. The Lackawanna River, the source indicated, is a dependable stream, not very acid and only a short distance from the company's breaker. The first move made was to run a 14-in. line to the center of the deepest part of the river channel, terminating it with a short length of vertical pipe.

This pipe line was connected at the shore end with the river pump, the house for which was sunk in the bank so as to give a minimum suction lift. This river unit is a 2,500-g.p.m. 50-ft.-head 1,160-r.p.m. double-suction volute all-bronze centrifugal pump driven by a 50-hp. motor. It discharges into a 14-in. wood pipe and thence to a vertical pipe which carries the water from the top to within $2\frac{1}{2}$ ft. of the bottom of a 25-ft.-diameter cone. A 30-in.-diameter plate through which passes a 4-in. pipe partially closes the bottom of this cone, but so large a volume of water is delivered that 80 per cent of it flows over the spillway around the cone mouth and only 20 per cent, or 500 g.p.m., passes out of the bottom pipe. By this means the solids in the water are segregated and carried by the 4-in. pipe into another line leading back to the river. Clear water from the spillway passes to the old concrete water-feed supply tank of the William A colliery, which is of 40-ft. diameter and about 10 ft. deep. From this the water is lifted to the breaker by a 2,000-g.p.m. 1,800-r.p.m. double-suction volute cast-iron centrifugal pump driven by a 75-hp. motor. This pump delivers to a 12-in. wood line.

Originally, a Savage mixer delivered a definite quantity of hydrated lime to the clear effluent from this breaker pump every 6 seconds, but it was found difficult to make lime mix with the water, so a 3-in. line was inserted in the pipe wall on the pressure side of the breaker pump, which now passes a part of the water back to a mixing tank into which the lime is dropped as before ten times per minute. Here the mixture is agitated and passed into a shallow cone into which four 1-in.-pressure pipes enter at right angles, assuring further agitation.

A pipe in the bottom of this cone de-

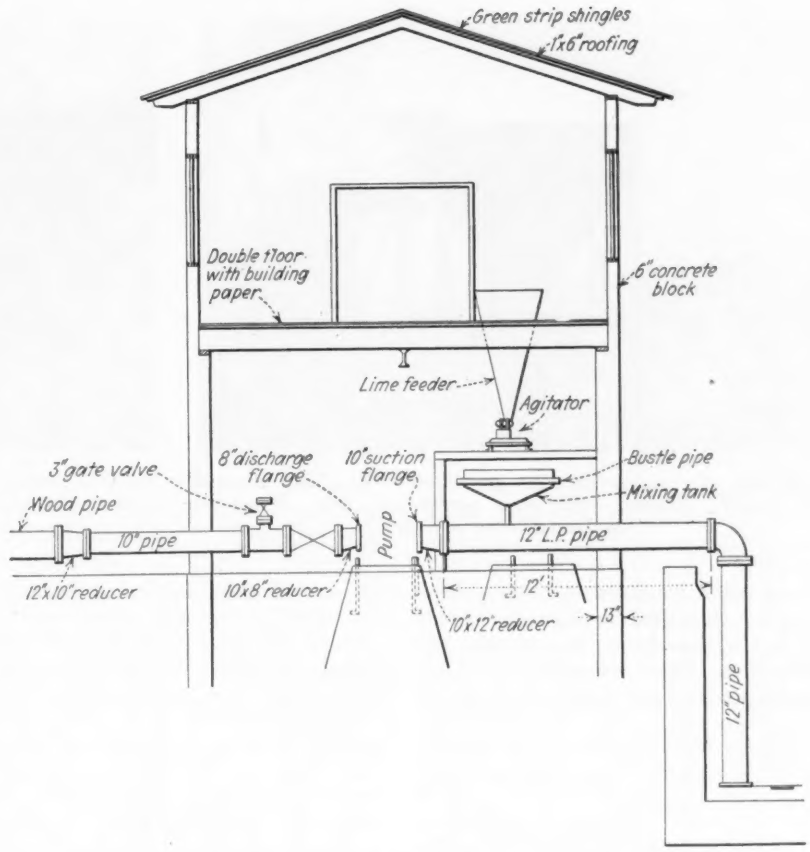
livers the mixture under pressure to the suction line. In this way not only is an intimate mixture of lime and water effected and the breaker protected against the acid content of the water but the pump itself is freed from corrosion. When taken apart after two years' operation it was found to be practically uncorroded, but a light coat of lime had been deposited on the inner surfaces—a good showing for a cast-iron pump.

Both river and breaker pumps are automatic in their operation and non-overloading; that at the river is regulated by a float in the 40-ft. feeder tank, so that, if the water at that point gets low, the river pump is started. One man attends the mixer; he feeds the lime, aids its passage should it stick and tests the treated water for alkalinity. The pH of the water is taken twice a day, at 10 a.m. and 2 p.m., and if the water is too acid or too alkaline, the deliveries of lime per minute are increased or decreased respectively. About two bags of lime (100 lb.) is used per hour. Tests are made with Brom n-Thymol Blue, and the pH maintained lies between 6.6 and 7; that is, it is kept rather on the acid side of neutral than on the alkaline side, for a mild acidity is not harmful and to maintain an alkaline condition would be costly.

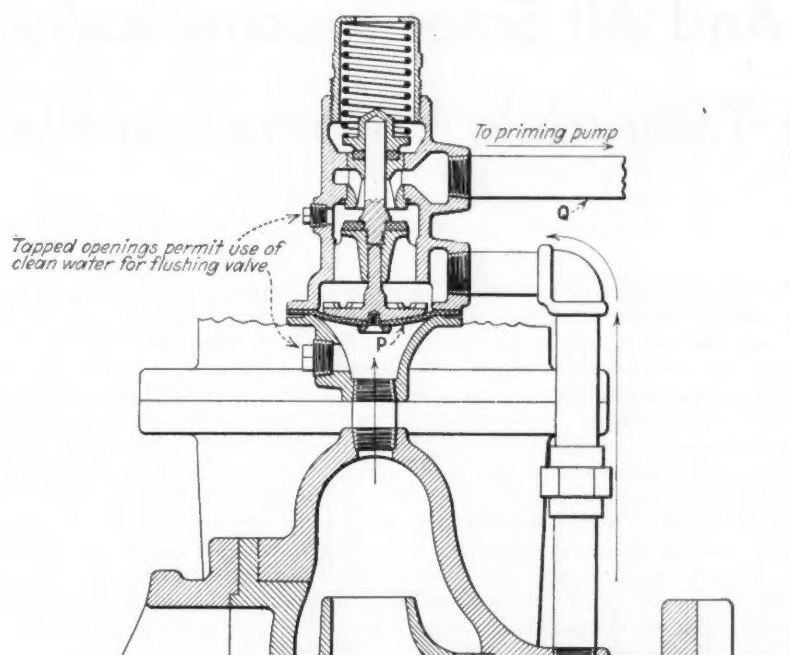
In the year's spring floods, the intake pipe at the river was carried away, so a breakwater was constructed from the bank on the upstream side of the pipe inlet, extended into the water a short distance and carried down the stream about 800 ft. Thus, all the water which enters the concrete box at the intake has to back up the channel. As it has to reverse its direction and travels at a low velocity, it drops many of its solids and the river pump has now a less difficult fluid to handle.

The breakwater is constructed of the bodies of old mine cars surmounted, filled and surrounded by a mass of gravel from the river bed which was put in place by a power shovel. The big flood in March removed much of the loose gravel, exposing the car bodies, which, nevertheless, held their place due to the weight with which they were loaded. As the backwater tends to fill up with silt, a scraper bucket and a $7\frac{1}{2}$-hp. hoist such as are used in the mine have been provided, and every week or two weeks a man operates the hoist and bucket and scoops the channel clean in two or three hours of operation.

Naturally, the standard priming valve of the river pump has difficulty in handling such excessively silty water, for when it was drawn through the pump it entered the valve chamber and tended to work under the valve seat and lodge in it. To prevent this, a diaphragm was placed at $P$, which precluded water from immediate contact with the valve. The priming connection, $Q$, being connected with the suction of the pump, this part of the valve is under vacuum and the




**Neutralization equipment at Kehoe-Berge's breaker pump station**




**Anti-silting priming valve at Kehoe-Berge's river pump station**

Breakwater of rock-loaded mine cars, backwater silting channel, with cleaning scraper, right; river pumphouse, left. Flood has uncovered some of cars

Breaker pumphouse and settling cone with flume for overflow of concrete sump and cone discharge. In the pumphouse the water is neutralized with lime

silt handled will not enter it. Since the new valve, installed by Barrett, Haentjens & Co., has been in operation, no trouble has been experienced. Two tapped openings are provided to permit the use of clean water for flushing out the valve in case any silt should enter.

With the final provisions, all the old difficulties have been ironed out. O. E. Kenworthy, consulting engineer, Kingston, Pa., devised, with A. B. Shutts, general superintendent, this inexpensive solution of a troublesome problem, which has been met before but with more elaborate equipment.

# LUMP BROKEN DOWN

## + And All Sizes Mechanically Cleaned At Talleydale Preparation Plant

By IVAN A. GIVEN

*Associate Editor, Coal Age*

COMPLEMENTING mechanical loading underground and providing facilities for mechanically cleaning all sizes now shipped, the Talleydale preparation plant of the Snow Hill Coal Corporation, Terre Haute, Ind., incorporates separate cleaning units for each primary size produced, equipment for the production of dedusted screenings and facilities for shipping mixtures of any or all primary sizes. With a design capacity of 500 tons per hour, the plant prepares and loads coal from the Indiana No. 3 seam containing, as mechanically loaded, approximately 15 per cent of refuse material. Shipments go out over the tracks of the Chicago, Milwaukee, St. Paul & Pacific R.R. from New Goshen, Ind.

Talleydale plant design exemplifies the major factors involved in preparing a coal to meet present-day market standards with a maximum of efficiency and a minimum of burden on operating cost. The relatively high refuse content of the raw coal reflects the presence of a number of impurity bands, both persistent and local in character, varying in composition from slate to pyrites (p. 491 of this issue), as well as the occurrence of pure pyrites in lenses and grains. Maximum consumer satisfaction naturally dictated the removal of as much of this material as is economically feasible from not only a part but all of the sizes shipped, while a desire to realize the maximum benefit from the cost-saving characteristics of the loading machines precluded any attempt to remove impurities at the face.

### Why Mechanical Cleaning?

With operating considerations favoring a shift in cleaning activities to the surface, market considerations involved recognition of the fact that cleaning must be extended to take in the small sizes impossible to hand-pick and also that results must be uniform in all sizes—a difficult objective with hand-picking in view of the large quantities of refuse material that normally would have to be removed. These considerations, as well as the possibility of eliminating large outlays for picking labor, pointed to the adoption of mechanical cleaning.

Attention to market requirements also was reflected in the installation of equipment for the shipment of mixtures, for dedusting screenings and for air-cleaning this size, thus avoiding the use of water, which would be difficult to remove from the screenings through natural drainage and consequently would involve expensive dewatering equipment or the shipment of this size in the wet state with the possibility of freezing in cold weather. Re-treatment of middlings and refuse and the recovery of pyrites achieve the dual objective of insuring maximum cleanliness of the

shipped product with salvage of all the valuable constituents of the raw mine product possible.

Major preparation equipment in the Talleydale plant, designed by Allen & Garcia, fabricated by the Marion Steam Shovel Co. and erected by the coal company, consists of a shaking picking table (not used as such under the present preparation set-up), a Bradford breaker, seven Vissac jigs, four Stump "Air-Flow" cleaners and two Algar dedusters, in additon to primary and sizing shakers, dewatering equipment—also used to remove degradation—mixing and refuse conveyors, loading booms and chutes, a water-clarification and slurry-recovery plant and other auxiliary equipment. An American Steel & Wire Co. aerial tramway is installed for refuse disposal.

### Oversize Broken Down

Talleydale coal moves primarily in the railroad and industrial markets and consequently lump is not shipped, although provisions are made for producing this size in the future, if desired. Therefore, all coal over 6 in. is broken down and run to the cleaners with the rest of the mine product. On this basis, primary sizes produced at present are: 3x6-in. egg, No. 1 jig; $1\frac{1}{4}$x3-in. small egg, No. 2 jig; $\frac{3}{4}$x$1\frac{1}{4}$-in. nut. No. 3 jig; $\frac{3}{8}$x$\frac{3}{4}$-in. nut, No. 4 jig; $\frac{3}{8}$-in. x 48-mesh screenings, Algar dedusters, Stump cleaners and No. 5 jig. Dust, when marketable, constitutes a sixth size (minus 48-mesh); otherwise, it is run to the refuse. Nos. 6 and 7 jigs are installed for the re-treatment of refuse, No. 7 producing pyrites, which is loaded out when marketable or disposed of with the refuse, and a middlings product. Middlings go to the No. 6 jig, which produces a clean-coal end recirculated to the preparation system and a final refuse which goes to the bank.

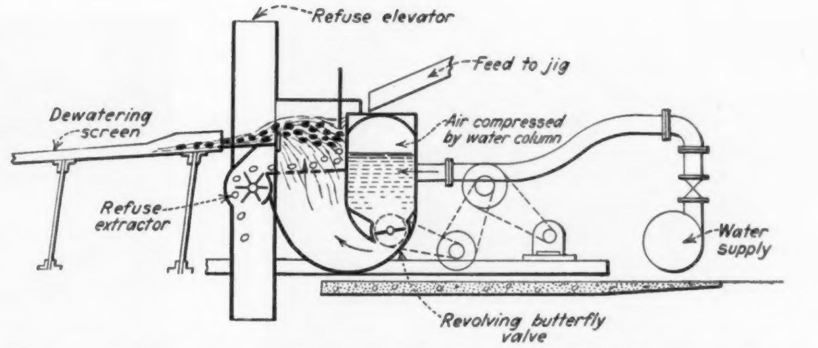



**Fig. 1—Diagrammatic sketch showing flow of water through jigs used at Talleydale**

Most of the $\frac{3}{8}$-in. x 48-mesh screenings is prepared in the Stump cleaners, as the No. 5 jig is installed primarily for the re-treatment of middlings from these units, although it also is designed to handle minus $\frac{3}{8}$-in. coal from the No. 6 jig and slurry from the water-clarification plant. Minus 48-mesh material in the coal end from the No. 5 jig is removed by wedge-wire sieves on the top deck of a Nordberg-Symonds horizontal dewatering screen. A gate on the top deck permits the wet coal to be loaded separately or combined with the dry product discharged onto the lower blank deck. Refuse from the No. 5 jig goes to the refuse conveyor for final disposal. Excluding slurry, dust and pyrites, final refuse is made at only three points in the plant: the air cleaners, No. 6 jig and No. 5 jig.

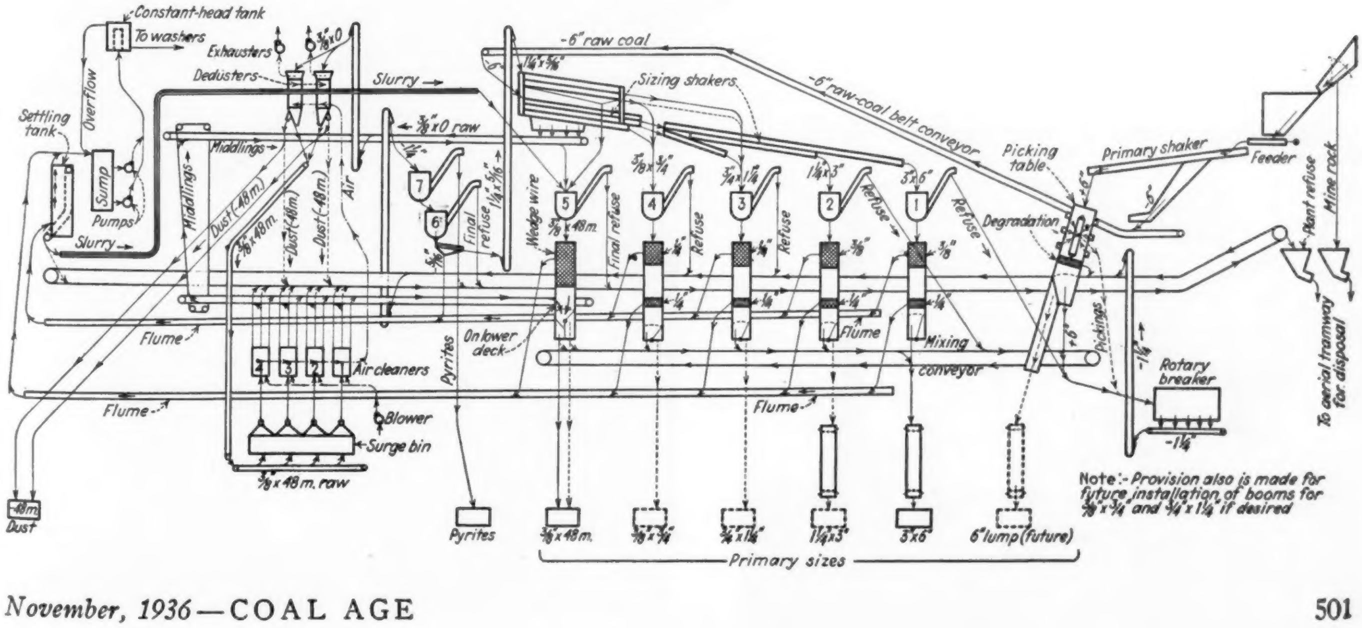
### Flow of Raw Coal

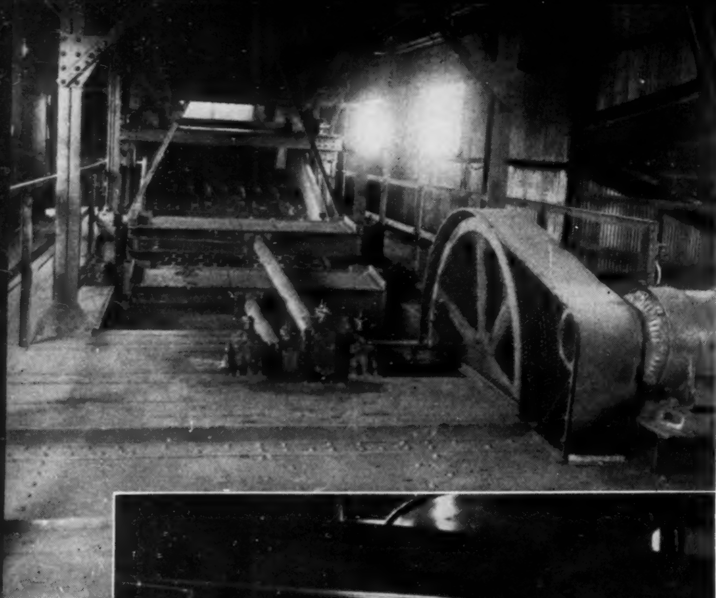
Raw mine-run enters the plant through a chute equipped with a fly gate for bypassing rock to a separate pocket at the aerial-tramway loading station. From the chute the coal flows into a 5-car hopper equipped with an automatic indicator to show the hoisting engineer whether or not the hopper is full. From the hopper an adjustable-speed reciprocating feeder moves the coal out onto the primary shaker, where it is separated into plus and minus 6-in. fractions. Coal over the 6-in. perforations is discharged onto a shaking picking table, at present used as a conveyor only and feeding into a Bradford breaker. If lump should be shipped in the future, the coal, after picking and passage over a degradation screen, will be discharged onto a loading boom over the lump track. Pickings will go to the Bradford breaker.

### Crushed in Breaker

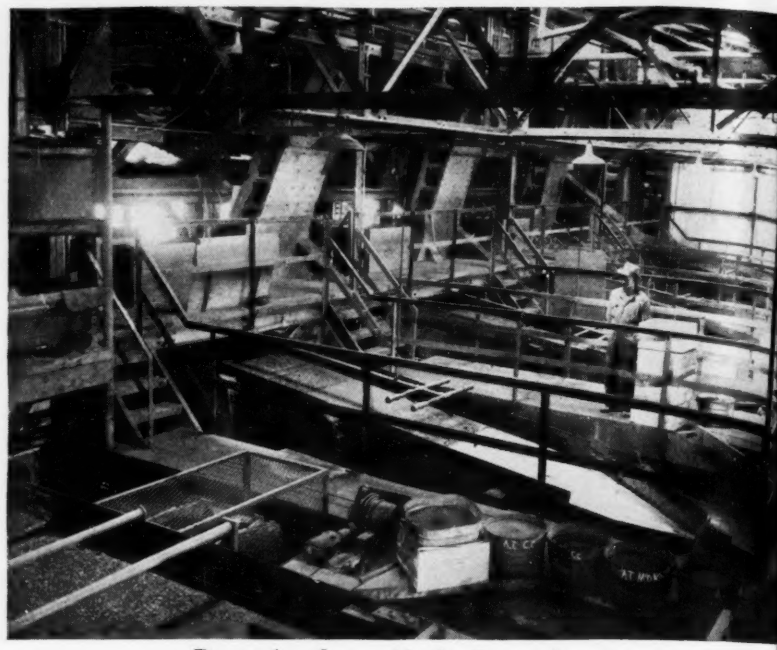
The breaker, which also receives the refuse from Nos. 1 and 2 jigs, is used solely as a crusher, reducing the material fed to it to minus $1\frac{1}{4}$ in. Incidentally, this means that no refuse over $1\frac{1}{4}$ in. is produced in the plant. Material discharged by the breaker is elevated to the top strand of the chain-and-flight refuse conveyor, which also receives the refuse from Nos. 3 and 4 jigs. Refuse and breaker product are discharged into an elevator leading up to the No. 7 jig. After re-treatment in No. 6 jig, the coal

**Fig. 2 — Flowsheet, Talleydale preparation plant. Certain alternative routes followed by the coal are shown by dotted lines**

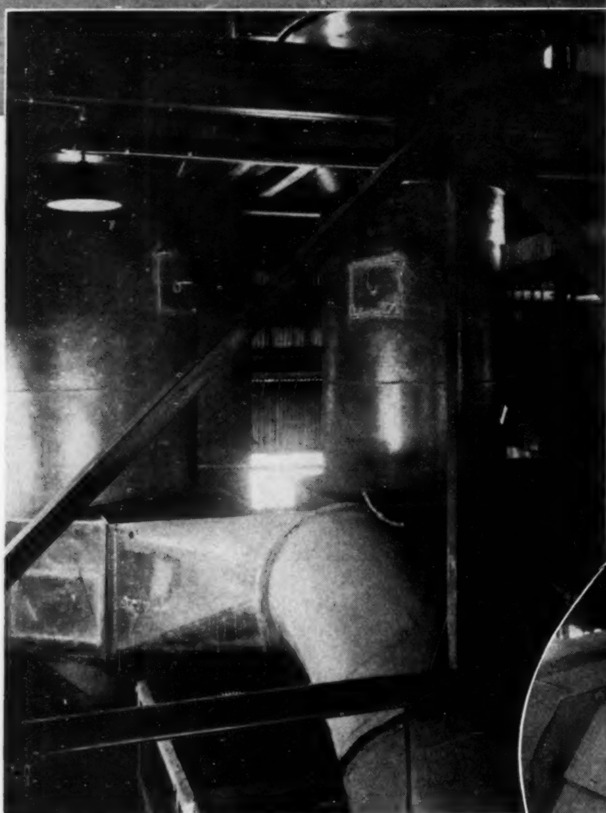




The primary shaker separates the mine-run coal into plus and minus 6-in. fractions prior to cleaning

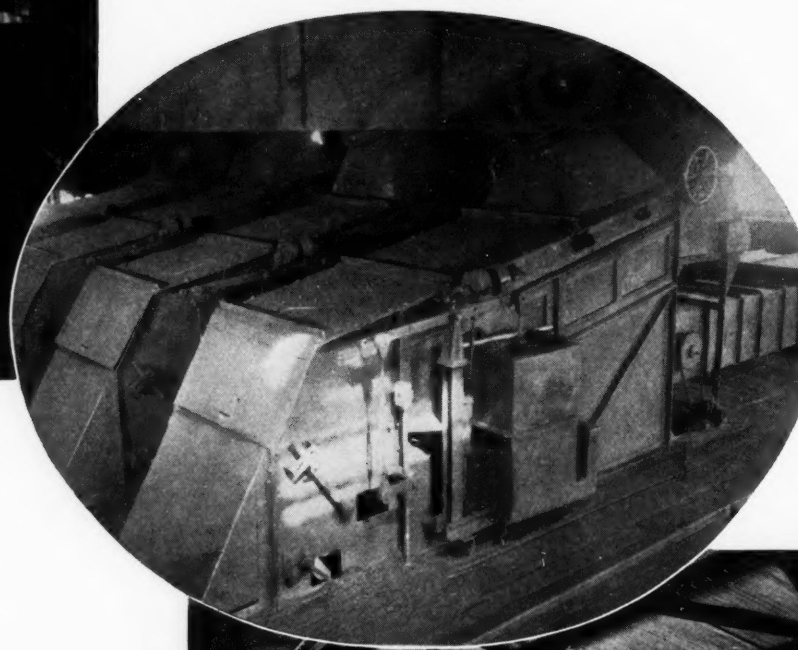


Dewatering floor, with the jigs to the rear



Two dedusters remove 48-mesh dust from the ⅜x0-in. raw coal prior to air cleaning

Four air cleaners remove impurities for ⅜-in. x 48-mesh coal from the dedusters



An aerial tramway with a capacity of 90 tons per hour disposes of mine rock and preparation refuse at Talleydale

Controls are grouped on the wall below the busbars, which are housed in a long steel cabinet with removable doors (shown removed in this view)

end passes over a "Jigger" screen, where it is separated into 1¼x$\frac{5}{16}$- and $\frac{5}{16}$x0-in. fractions. The undersize flows with the water to a flume leading to the clarification and slurry-recovery plant, where it is combined with other fines made in washing and dewatering for re-treatment in No. 5 jig or disposal with the refuse. Oversize from the "Jigger" screen is elevated to a narrow auxiliary screen mounted on the side of the upper sizing shaker, where it is sized and distributed to the appropriate jigs.

## New Type Jigs Used

Coal through the 6-in. perforations of the primary screen is transported on a 36-in. belt conveyor to the sizing shakers, where it is separated into 3x6-, 1¼x3, ¾x1¼-, ⅜x¾- and minus ⅜-in. sizes. All sizes, except the minus ⅜-in., are run to their respective jigs for cleaning. These jigs, the first of their type in the United States, are equipped with a single refuse elevator opposite the feed and function through the intermittent flow of water from a constant-head tank up through the washing bed, which is retained on a screen. Admission of water to the washing compartment is controlled by a butterfly valve. When the valve is closed, the water rises and compresses the air in an auxiliary air chamber. When the valve, operated by a motor, opens, water is driven into the washing compartment and the excess, carrying with it the cleaned coal, overflows the discharge end of the jig. Refuse is removed by a star evacuator with float control. Flow of water through the jig is shown diagrammatically in Fig. 1.

Cleaned coal from the egg and nut jigs (Nos. 1 to 4) is discharged into reciprocating conveyor troughs each fitted with two sections of perforated plate for dewatering and removal of degradation (see flowsheet, Fig. 2). The lower end of each trough is fitted with a gate to permit diverting the coal either to the railroad car via a loading boom or telescopic chute or onto a horizontal screen for dewatering. Water and fines from the conveyor troughs and screen flow into flumes discharging into the water-clarification and sludge-recovery plant.

In the clarification and recovery plant the discharge of one flume is received by a settling tank, from which the coal is removed by a chain-and-flight conveyor feeding to the refuse conveyor or to a Redler conveyor to No. 5 jig—normally the latter. The water overflows into a sump, which also receives the discharge of the second flume, carrying somewhat finer material in much less volume. From the sump the water passes to either of two Allis-Chalmers screw-type circulating pumps, one of which serves as a standby unit. Capacity of each pump is 15,000 g.p.m. These pumps discharge to the constant-head tank. In normal operation, the circulating water flow is approximately 15,000 g.p.m. Make-up water, which is added through sprays over the reciprocating conveyor troughs and Symonds screen, aggregates 200 to 400 g.p.m.

## Fine Coal Dedusted

Minus ⅜-in. raw coal through the bottom deck of the upper sizing shaker is conveyed and elevated to the two Algar dedusting units, which receive their air from the Stump cleaners. Dust may be chuted to a railroad car or run to the refuse conveyor. Dedusted coal (⅜ in. x 48-mesh) is conveyed to a surge and storage bin ahead of the air cleaners, which is equipped with a distributing conveyor.

Three products are made by the air cleaners: clean ⅜-in. x 48-mesh coal, middlings and refuse. The clean coal is transported by a short transfer conveyor to the lower (blank) deck of the Symonds screen. Refuse goes to the refuse conveyor, and middlings are fed onto the lower strand of the transfer conveyor for eventual discharge into the No. 5 jig for re-treatment. Air for the operation of the cleaners is supplied by a Sturtevant blower with a capacity of 20,000 c.f.m. American Blower Co. exhausters discharging directly to the atmosphere take the air from the dedusting units.

Fresh water for use in the preparation plant is obtained from the old Submarine mine, where a 600-g.p.m. Peerless deep-well pump has been installed. Submarine water originates from breaks into the Wabash River gravel and is non-acid.

Sixty-two motors totaling 959 hp. operate the equipment in the Talleydale plant. With the exception of a few special and fractional-horsepower units (Table III), these motors are of the Allis-Chalmers Type ARZ inclosed fan-cooled type designed for across-the-line starting at 440 volts. Current at 440 volts for tipple operation is supplied by a subsidiary 2,300/440-volt transformer station. Emergency stop buttons are installed on all motors except those operating the Fairmont car retarders.

**Table I—Operating Results, Talleydale Preparation Plant**

| | Specific Gravity | Screen Size: 3 x 1¼-In., Weight Per Cent | 1¼ x ¾-In., Weight Per Cent | ¾ x ⅜-In., Weight Per Cent | Minus ⅜-In., Weight Per Cent |
|---|---|---|---|---|---|
| Feed | Under 1.40 | 78.4 | 82.9 | 82.3 | 72.9 |
| | 1.40—1.50 | 3.9 | 5.1 | 6.1 | 8.1 |
| | 1.50—1.60 | 1.4 | 2.3 | 2.8 | 4.4 |
| | 1.60—1.70 | 1.7 | 2.9 | 2.1 | 6.3 |
| | Over 1.70 | 14.6 | 6.8 | 6.6 | 8.3 |
| Clean Coal | Under 1.60 | 97.2 | 97.0 | 96.0 | 92.4 |
| | 1.60—1.70 | 1.0 | 1.4 | 1.4 | 3.1 |
| | Over 1.70 | 1.8 | 1.6 | 2.6 | 4.5 |
| Refuse | Under 1.60 | 0.8 | 3.9 | 8.5 | 12.2 |
| | Over 1.60 | 99.2 | 96.1 | 91.5 | 87.8 |

| Final Refuse from Rewash Jig | | Solids from Sludge Tank | |
|---|---|---|---|
| Under 1.60 | Over 1.60 | Under 1.60 | Over 1.60 |
| 3.4 Per Cent | 96.6 Per Cent | 67.2 Per Cent | 32.8 Per Cent |

**Table II—Motor Applications, Talleydale Preparation Plant**

| Service | Number of Motors | Motor Horsepower |
|---|---|---|
| Rock gate | 1 | 2 (a) |
| Feeder | 1 | 10 |
| Primary shaker | 1 | 25 |
| Picking table | 1 | 10 |
| Bradford breaker | 1 | 75 (b) |
| Breaker collecting conveyor (belt) | 1 | 5 |
| Breaker-product elevator | 1 | 10 |
| Main belt (—6-in. coal) | 1 | 25 |
| Upper sizing screen | 1 | 15 |
| Lower sizing screen | 1 | 15 |
| Jigs (Nos. 1 to 6), dewatering troughs (1 to 4) | 4 | 10 |
| Refuse elevator, No. 1 jig | 1 | 5 |
| Refuse elevators, Nos. 2 to 5 jigs | 4 | 3 |
| Symonds screen | 1 | 10 |
| Elevator to pyrite (No. 7) jig | 1 | 7½ |
| Pyrite (No. 7) jig | 2 | 5 (c) |
| Refuse elevator, No. 7 jig | 1 | 3 |
| Oil pumps, jig valves | 1 | ⅓ (d) |
| Jigger screen | 1 | 5 |
| Clean-coal elevator from jigger screen | 1 | 3 |
| Deduster feed conveyor | 1 | 15 |
| Deduster feed elevator | 1 | 15 |
| Deduster vibrators | 2 | 1½ |
| Deduster valve | 1 | 2 |
| Deduster exhausters | 2 | 30 |
| Stump feed and distributing conveyors | 1 | 25 |
| Stump drive | 1 | 5 |
| Cleaned-coal and middlings transfer conveyors | 1 | 15 |
| Stump blower | 1 | 75 (e) |
| Slurry conveyor | 1 | 7½ |
| Redler conveyor to No. 5 jig | 1 | 10 |
| Circulating pumps | 2 | 125 (f) |
| Mixing conveyor | 1 | 50 |
| Mixing conveyor gates | 4 | ¼ (a) |
| Refuse conveyor | 1 | 50 |
| Chute hoists | 3 | ⅓ (d) |
| Boom motors | 2 | 7½ |
| Boom hoists | 2 | 2 |
| Car retarders | 6 | 1 (g) |
| Aerial tramway | 1 | 60 (h) |

* All motors, with exceptions indicated, are Allis-Chalmers, Type ARZ, inclosed, fan-cooled, 440 volts, linestart, and equipped with stop buttons.

(a) With limit switches.

(b) Slip-ring, 2,300 volts, semi-automatic starting.

(c) U. S. Varidrive motors.

(d) General Electric.

(e) 2,300 volts.

(f) Synchronous, 2,300 volts, semi-automatic starting.

(g) Without stop buttons.

(h) Slip-ring.

Starting buttons are grouped in a control station over the walkway in front of the jigs. Control units are grouped on a panel on the top floor of the plant. In installing the control equipment, busbars were housed in a long sheet-steel cabinet equipped with removable doors (see accompanying illustration) to facilitate changes when necessary. This cabinet is fixed to the tipple framework above the control panel. Allis-Chalmers V-belt drives, either alone or in combination with other reduction equipment, predominate, supplemented by a few speed-reducer and chain drives.

Refuse disposal at Talleydale is handled by American Steel & Wire Co. aerial tramway of the two-bucket reversible, or jib-back, type with an average capacity of 90 tons per hour. Length of the tramway is 1,250 ft., with a rise of 183 ft. against the load. Maximum speed is 800 f.p.m., and bucket spacing is adjusted to give an average of 25 trips per hour. Bucket capacity is 72 cu.ft., accommodating 7,200 lb. of material. The tramway is driven by a 60-hp. motor through a speed reducer and special wire-rope-driving sheave. A manually operated brake is included. The two track cables are of the 1⅞-in. locked-coil type, and a ¾-in. 6x19 Seale patent Lang-lay high-strength traction rope is used. Tramway buckets are loaded from separate bins (mine rock and plant refuse) adjacent to the shaft and equipped with hand-operated undercut gates.

## *Snow Hill High Spots*

**Snow Hill not only has given new life to an old mine but has revitalized interest in the No. 3 coal of Indiana because of the cleaning methods used and the possibilities of turning refuse material into a commercially salable product. Among the features of this completely mechanized operation described in this article and in the companion story starting on page 491 are the use of track-mounted cutting and loading machines; 5-ton solid-end all-steel cars; overturning cages; special timbering, with steel and concrete arches, and air-conditioning.**

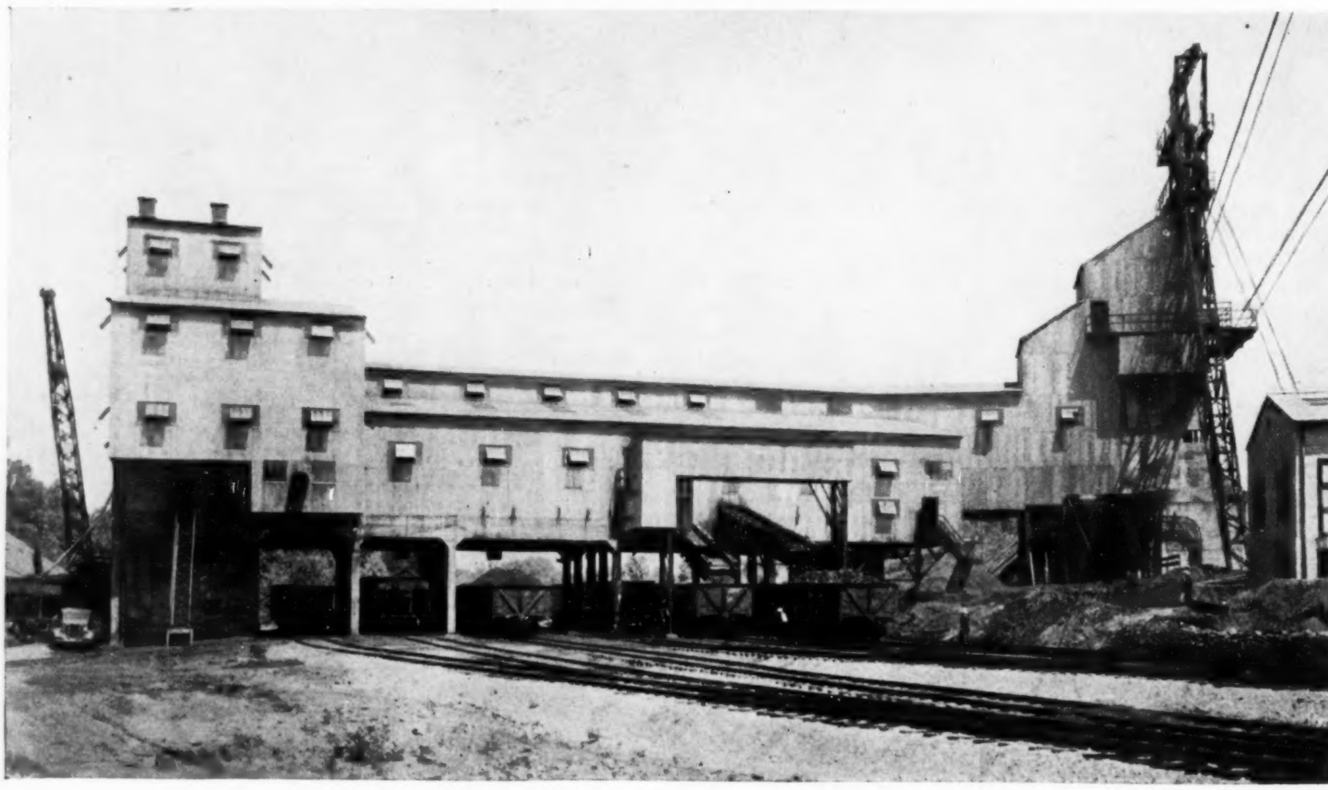
★ ★

Refuse is dumped between the intermediate tower and the tail masts. The latter were located about 150 ft. on either side of the tramway center line to secure the necessary storage capacity —about 1,000,000 tons. Height of the tail masts, equipped with backstays to resist track-cable tension, as well as two guy lines each, is 160 ft. One mast is fitted with the necessary equipment to permit the counterweighting the traction rope. Tripper carriages on the bucket carriers dump the buckets automatically when the direction is reversed. Changing the dumping point is accomplished by changing the location of one of the carriers along the traction rope, which in turn affects the location of the buckets with respect to each other.

Track cables are located as close together as possible at the loading chutes, as each bucket is loaded from either of the two bins. At the intermediate tower, the cables are flared out to a 14-ft. gage, which is increased to 300 ft. at the tail masts. Height of the intermediate tower, which is 370 ft. from the loading terminal, is 90 ft. It not only accommodates the usual break-over angle made by the cables but also permits them to flare out on a horizontal angle of about 9 deg. to the center line. The tramway crosses the loaded tracks at an angle of about 45 deg. One of these tracks is straddled by the tower, which incorporates a guard net.

The Talleydale preparation plant is operated by a force of nine men, as follows: three jig and screen men; one loading-boom and car-retarder operator; one empty-car dropper; one loaded-car dropper; one general-duty man under tipple; one tramway operator; and one roustabout.

**General view of the Talleydale preparation plant. The aerial-tramway loading station is at the right next to the hoisting shaft. Jigs are located in the center bay and the dedusters and air cleaners in the left-hand end.**



# MECHANIZATION

## + Makes Rapid Strides

## In Bituminous Mining Industry*

**By PAUL WEIR**

*Vice-president*
*Bell & Zoller Coal & Mining Co.*
*Chicago*

ALTHOUGH commonly used as a synonym for "mechanical loading," mechanization really has a much broader meaning. Very properly, it refers to the use of mechanical and electrical devices on any or all of the individual operations in coal extraction and preparation. Just as we have mechanical loading, we also have mechanical haulage, mechanical cutting, mechanical drilling, etc. Today, we find in the United States a very few small mines with no mechanical equipment except mine cars. At the other extreme we have large mines fully equipped with every possible mechanical and electrical device from the face to the railroad cars.

The extent to which mechanization of production methods in the mines of this country has progressed is indicated by these statistics. During the year 1934 (the latest year for which complete figures are available), 84.1 per cent of the underground production of bituminous coal was cut by machines; 10.7 per cent was mined by hand and 5.1 per cent was shot off the solid. Surface or strip-pit mining contributed 5.8 per cent of the total bituminous production. Tonnage loaded by loading machines, pit-car loaders and conveyors was 12.2 per cent of the total underground production. In the anthracite region of Pennsylvania, 19.1 per cent of the underground production was loaded mechanically. Sales of mining machinery indicate that the statistics for 1935, when compiled, will show a substantial increase in mechanization for that year. This trend is even more pronounced during the first half of 1936.

Generally speaking, what is being done today in the United States is the mechanizing of production methods at existing mines without changing the method of mining. A simultaneous change in mining as well as production methods invariably leads to extremely difficult problems. Because of the large capital investment necessary for complete mechanization, there always is necessity for keeping in service as much as possible of existing equipment. This fact, together with limitations of sizes of shafts and widths of entries, determines the degree to which mechanization can progress at existing mines.

★ ★

**• The tremendous developments in mechanization during the last decade indicate that future designs of mines will differ greatly from our present practice. Because of high wage scales and intense competition with oil and gas, the trend is toward the employment of a maximum of machinery and a minimum number of miners.**

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The full benefits of complete mechanization can seldom be had under these conditions. During the last few years very few mines have been constructed. Eventually new mines designed to employ the most modern of equipment will be constructed. Then it will be possible to obtain the highest degree of efficiency. Our present mechanization is simply a compromise between the old and the new.

Mechanical loading has emphasized the necessity for a high degree of efficiency in haulage. In addition to this, the average length of haul in existing mines is constantly increasing. These two things have resulted in a trend toward heavier locomotives, better track and larger mine cars. Single locomotives as large as 38 tons are now in use. In extreme service we find being used rail as heavy as 90 lb. per yard, and ties as large as 7x9 in. in cross-section. In some cases the rail is made continuous by electric welding or Thermit welding. The ties are preserved against decay by one of several standard processes.

The capacity of mine cars, while largely limited by the thickness of the coal bed, has been greatly increased by careful design. Cars of four-ton capacity are now in use in a seam as thin as 36 in. Six-ton cars are quite common in beds 6 ft. and more in thickness. In these thicker seams undoubtedly we will soon see 8- and 10-ton cars.

Universal track-mounted cutting machines have been developed to do marvelous work. This machine can top cut, bottom cut and cut horizontally at any plane in the seam, and in addition it can shear the ribs and also shear at any place across the face. Shortwall machines have been improved so that in many cases their capacity has been doubled. Tipping and heat-treatment of bits has been given much attention and substantial reductions in costs have been obtained by their use.

From the standpoint of safety, it is interesting to note that the industry is changing rapidly from the use of black powder to permissible explosives. The great advance of mechanization has brought with it the development and extensive application of Cardox and Airdox.

Loading machines, while once limited to coal 5 ft. and over in thickness, have been developed to work in beds as thin as 36 in. In the thicker coal the usual practice is to load directly into mine cars. In the thinner seams the machines load onto conveyors. One of the recent outstanding developments is this mechanization of production methods in these thin seams. Conveyors of the

* From an address entitled "Latest Developments in Bituminous Coal-Mine Mechanization," delivered at the Post-Conference Tour of the Third World Power Conference, Pittsburgh, Pa., Sept. 16, 1936.

belt, flight and shaking types are widely used for transporting coal from the face to the entries. The actual loading may be by hand or by machines. On the entry the coal may be loaded onto another conveyor or into mine cars. These entry conveyors (mother belts) are coming into general use. At the present time there are in existence, or in the process of construction, at least eight so-called trackless mines in which coal is transported from the face to the preparation plant on conveyors.

In surface or strip-pit mining, electric shovels having dippers of a capacity up to 32 cu.yd. have been developed. The effect of this has been to increase greatly the ratio between thickness of overburden and thickness of coal seam which can be profitably mined. Automobile trucks and trailers having bodies the capacity of which approximates 25 tons are being used for transporting the coal from these surface pits to the preparation plant.

It is becoming more and more apparent that mechanical cleaning is a necessity when mechanical loading is employed. The presence of an increased quantity of impurities from the roof and bottom, as well as from the seam itself, in mechanically loaded coal can be expected. This, together with an ever-increasing demand by customers for cleaner coal, makes the mechanical cleaning plant a necessary adjunct of mechanical loading. During the year of 1934, 11.1 per cent of the entire bituminous production in this country was mechanically cleaned. A substantial increase is indicated for 1935 and 1936.

Manufacturers of mining machinery are taking advantage of the special steels which the automotive industry has developed for shafting, gears, bearings, etc. This has resulted in a greatly decreased cost of maintenance and also increased capacity per unit through the elimination of breakdowns.

In the eastern section of the country production on multiple shifts is established. Production on as many as three shifts per day is common practice. The effect of this is to decrease greatly the amount of invested capital per ton of daily production. This multiple-shift operation has its problems of delivery of materials and of maintenance and servicing machines, but they are being solved vary rapidly.

Production methods are being looked upon largely as problems in industrial engineering, just the same as factory production is a problem in industrial engineering. However, inasmuch as practically all mining is carried on underground, its problems are more complicated than those of a factory.

# SHAKER CONVEYORS

## + With Duckbill Loading Heads Speed Up Anthracite Production *

By FRANK H. WAGNER
*Vice-President and General Manager*
*Lehigh Valley Coal Co.*
*Wilkes-Barre, Pa.*

IN THE last ten years mechanized loading underground has shown a steady increase in the coal mines of the United States. References in this article to mechanized loading apply to the use of equipment that eliminates the task of hand shoveling. In the bituminous field the largest increase in mechanized loading has been in the use of mobile loaders of the track and caterpillar type which load the coal directly into the mine car at the face. Unfortunately, conditions in the anthracite field are not conducive to the efficient use of this type of equipment.

To meet the economic demand for cheaper production, the anthracite industry turned to the use of scraper loaders and shaker conveyors. As experience was gained in the use of these devices, it was found that in many places the conditions were such that a shaker conveyor could be used more advantageously than a scraper loader, hence the scraper loader is barely "holding its own," while the use of shaker conveyors is steadily increasing.

In itself the shaker conveyor is not a mechanical loading unit. It was quickly realized that maximum efficiency could not be obtained as long as the material was lifted onto the conveyor by manual labor and as long as the number of cars loaded remained the yardstick by which the miner gaged his efforts. To meet the needs of mechanical loading with shaker conveyors and to eliminate the drudgery of hand shoveling, the duckbill, a self-shoveling head attached to the inbye end of a shaker conveyor, was introduced, in which a shovel trough is advanced or retracted by a mechanism that utilizes the power of the conveyor drive through the reciprocating motion of the conveyor line.

The first duckbill of which we have record was introduced in the anthracite field in 1927. Though a rather crude affair, it loaded coal with some success. Its operation was eventually discontinued because of its imperfections and because so much manual labor was required in its operation. However, the results of the experiment were encouraging, and during the period from 1927 to 1930 some seven or eight duckbills were installed and tried under various conditions of mining.

During this period the mechanism was improved, and in 1931 the Type LA duckbill was introduced into the anthracite field. During the next two years about ten installations were made of the Type LA duckbills, some of which were very successful.

The experience gained with these installations showed that a smaller and lighter unit would better meet the conditions, and a new design called the Type LOa was introduced. About twenty installations were made during 1933, and after the success obtained with them, about 29 additional units were installed during 1934, and about 30 more during 1935. This new duckbill (Type LOa) was an improvement over its predecessors, and many successful installations are in operation today, but it was found that this duckbill could not be operated on many of the shaker

*Abstract of a paper entitled "Application of Duckbill Loaders in Anthracite Mines," presented at the fall meeting of the Coal Division of the American Institute of Mining and Metallurgical Engineers, Pittsburgh, Pa., Oct. 21, 1936.

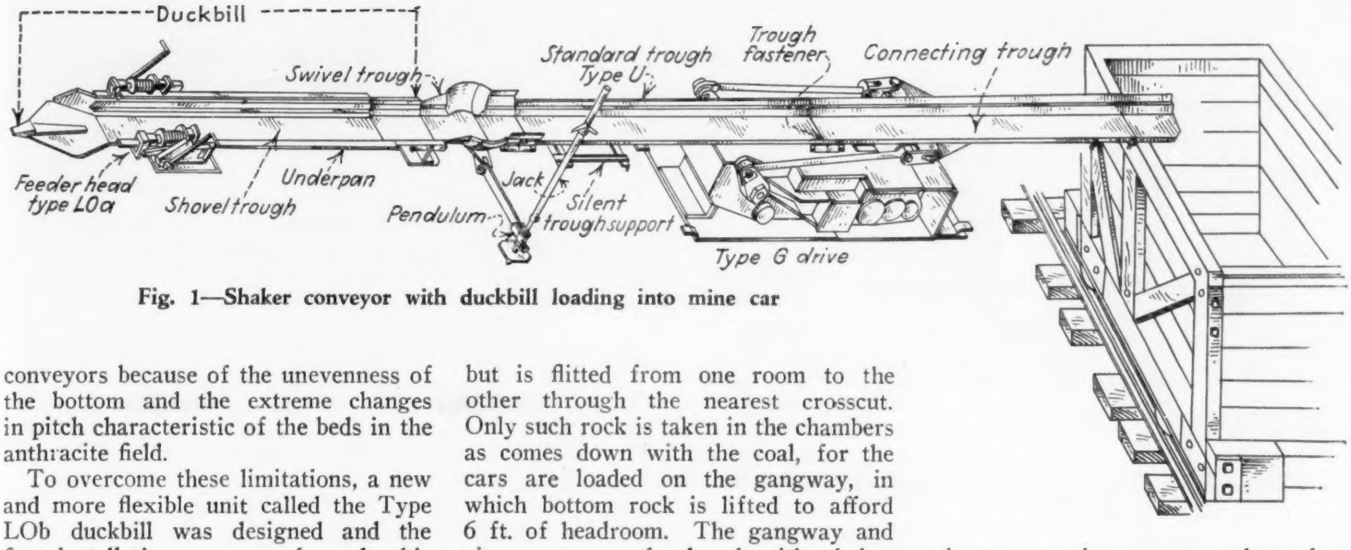



**Fig. 1—Shaker conveyor with duckbill loading into mine car**

conveyors because of the unevenness of the bottom and the extreme changes in pitch characteristic of the beds in the anthracite field.

To overcome these limitations, a new and more flexible unit called the Type LOb duckbill was designed and the first installations were made early this year. The operation of the latest type having been satisfactory, all duckbills installed thus far this year have been of this type. Duckbills can be used wherever a self-loading device is desired in conjunction with a shaker conveyor. They will load coal, rock, silt and ash, and are being used in both the Northern and Southern anthracite fields.

*Example No. 1*—Duckbills are being operated in chamber mining under widely diversified conditions, with a corresponding variation in results attained. As a typical example an installation has been selected in a comparatively flat bed with 32-in. coal and 6- to 10-in. top rock that comes down with the coal and must be gobbed at the face.

### Undercutters Used

As with most duckbill installations in chamber mining, undercutters are used, for they have many advantages. The time saved in drilling and shooting greatly speeds the preparation of the face for loading. Where the coal has been undercut, only from a quarter to a third as much explosive is required as in shooting off the solid, thus producing a better grade of coal, lessening the fire hazard, and making safer working conditions under tender or bad roof because of the great reduction in roof shock. Moreover, undercut coal falls down when shot close to the face, where it can be quickly loaded by the duckbill, whereas coal shot from the solid usually scatters over a considerable distance from the face, where much of it cannot be reached by the duckbill and will have to be shoveled onto the conveyor by hand.

In Fig. 2, chambers are driven 30 ft. wide in pairs, one undercutting machine taking care of two chambers. A shaker conveyor equipped with a duckbill is used in each room. As no track is laid in the chamber, the undercutting machine is not loaded on a truck but is flitted from one room to the other through the nearest crosscut. Only such rock is taken in the chambers as comes down with the coal, for the cars are loaded on the gangway, in which bottom rock is lifted to afford 6 ft. of headroom. The gangway and aircourses are developed with shaker conveyors equipped with duckbills, but this phase of the operation will be covered later in this article.

The crew consists of ten men. One miner and two laborers work in each chamber, two men operate the undercutting machine and two men top the cars on the gangway. This is a larger crew than generally is used in chamber mining with undercutting machines and duckbills, because the top rock must be cleaned off the coal at the face and because occasionally the roof becomes bad.

In some chamber work where conditions are better, fewer men are required and the loading crew and cutting-machine crew alternate in two chambers. The division of labor between the preparation crew and the loading crew is altered to meet varying conditions.

While one face is being timbered, undercut, drilled and prepared for loading, the other place is being loaded out. When these operations are completed, the cutting machine moves to the other face and the operations are reversed. When the cycles in the two chambers get out of step, the crosscuts driven between the chambers on 60-ft. centers serve as a balance between the preparation and loading crews.

### Two 6-Ft. Cuts per Shift

Where normal conditions are encountered, two 6-ft. cuts are taken out of each chamber per 8-hour shift, which gives an average advance of two chambers, including the cross headings, of 10 ft. per 8-hour shift; the work is double-shifted. When conditions are abnormal and top rock is unusually heavy, the rate of advance drops to three 6-ft. cuts taken out of the two chambers, or an average of $1\frac{1}{2}$ cuts per place per 8-hour shift.

*Example No. 2—Development of Car Gangway and Aircourses in a Flat Bed*—In the chamber mining described in Example No. 1, coal is loaded into the mine cars on the gangway, where about 3 ft. of bottom rock is lifted for additional height; no bottom rock is shot in the aircourse. Both gangway and aircourse are developed with duckbill-equipped shaker conveyors.

### Mounted on Special Truck

In the gangway a shaker-conveyor drive is mounted on a special truck, which enables it to be moved on the track. When the drive is in operating position, the truck is jacked up and held off the rails by sills placed across the track between the rails and the frame of the truck. In this position the shaker drive can be held in place in the customary manner with ratchet screw jacks against the roof. The shaker-conveyor pan line extends over the drive and is suspended from the roof over the center of the track for a sufficient distance to permit three cars to be pushed under it at a time for loading. The face of the gangway is driven 20 ft. wide to allow room for gobbing the top rock that comes down with the coal. Coal is shot from the solid and loaded with a duckbill.

Until the shaker conveyor has been extended to its maximum length of 300 ft., coal only is taken. The duckbill is then detached and transported on the conveyor back to the shaker drive. The pans on the trough line are then disconnected and laid over against the rib. The duckbill is then attached near the drive and from the same setting of the equipment the bottom rock is lifted 12 ft. wide and about 3 ft. thick. A row of timbers is set to break the rock along the gob line. The rock is shot and then loaded with the duckbill, and the conveyor line is advanced as the rock is lifted until within about 10 ft. of the coal face. The conveyor line is then disconnected, the track extended, the conveyor drive moved up 300 ft. and the cycle repeated.

While advancing in the coal, the crew consists of one miner and three laborers and averages about 12 ft. advance per

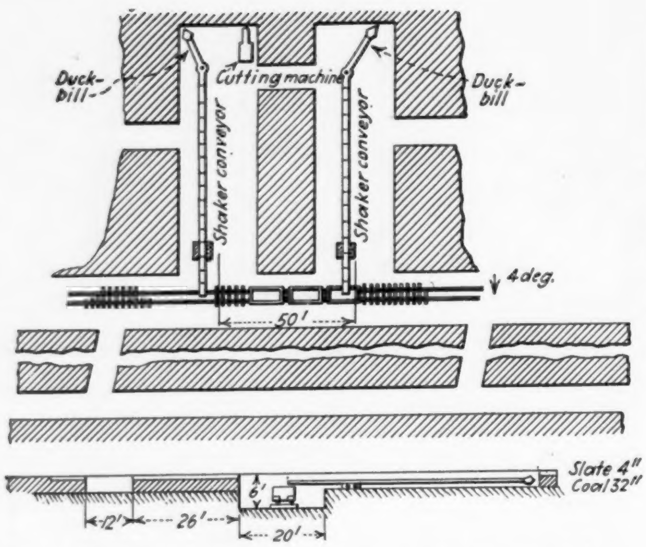



Fig. 2—Chamber mining. One cutting machine to two faces.

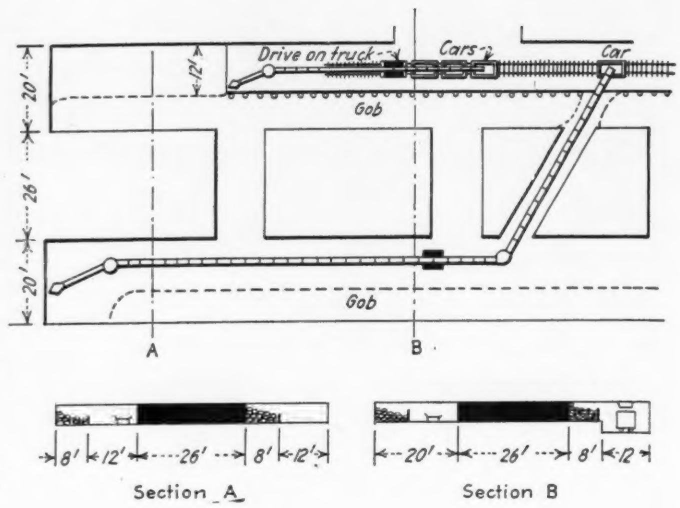



Fig. 3—Development in car gangway—Method 1.

8-hour shift. When taking the bottom rock, the crew is reduced to one miner and two laborers and averages 10 ft. advance in the rock per 8-hour shift.

Crosscuts between the aircourse and gangways are driven on 50-ft. centers and every sixth crosscut is put on a 45-deg. angle. No bottom rock is lifted in the crosscuts or in the 24-ft. aircourses, and a shaker conveyor equipped with a duckbill is used for driving the aircourse. The conveyor drive is set in the aircourse and a 45-deg. swivel trough permits the discharge end of the conveyor to be brought through the 45-deg. crosscut to load the coal into cars on the gangway. The coal is shot from the solid, and top rock that comes down with the coal is gobbed at the face. The crew driving the aircourse consists of one miner and three laborers, and the average advance is 9 ft. per shift.

The two crews divide the work of driving crosscuts so as to keep the advance of aircourse and gangway about equal. The average advance of the completed gangway and aircourse, including crosscuts, is 6 ft. per 8-hour shift. This work is double-shifted.

In a different section of the same mine, where coal is mined in chambers with duckbill-equipped shaker conveyors and the coal is being undercut, greater speed was desired in the development of the aircourse and gangway. To accomplish this, an undercutting machine and three shaker conveyors, each equipped with a duckbill, were used for the development. The undercutting machine alternated between the face of the gangway and the face of the aircourse and also cut the crosscuts as well as the first cuts in the chambers.

In the gangway one duckbill-equipped shaker conveyor loaded coal and at the same time a similar shaker conveyor loaded the rock. In the aircourse one shaker conveyor equipped with 90-deg. turn and duckbill loaded the coal. No rock was taken in the aircourse. The operation was similar to that described in Example No. 2 except that no refuse came down with the coal and the gob space could be utilized for the installation of the second conveyor along the rib in the gangway.

The crews consisted of one operator and one helper on the cutting machine and one miner and two laborers on each of the three duckbill-equipped shaker conveyors. Crosscuts between the aircourse and gangway were driven opposite to the chambers so that such places could be opened on either side where desired. Average advance in each face of coal and also in the rock was 12 ft. per 8-hour shift. This work was triple-shifted with an advance of the completed gangway and aircourse, including crosscuts and room necks, of 30 ft. per day.

*Example No. 4—Gangway Development in Pitching Beds*—Gangway development is one of the high-cost items in mining coal on running pitch. Many duckbills have been installed on this kind of work, with gratifying results.

Fig. 4—Development in car gangway—Method 2.

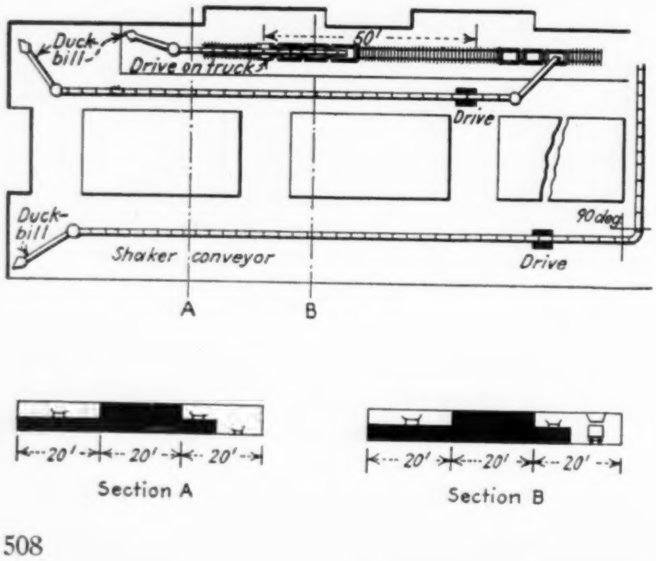
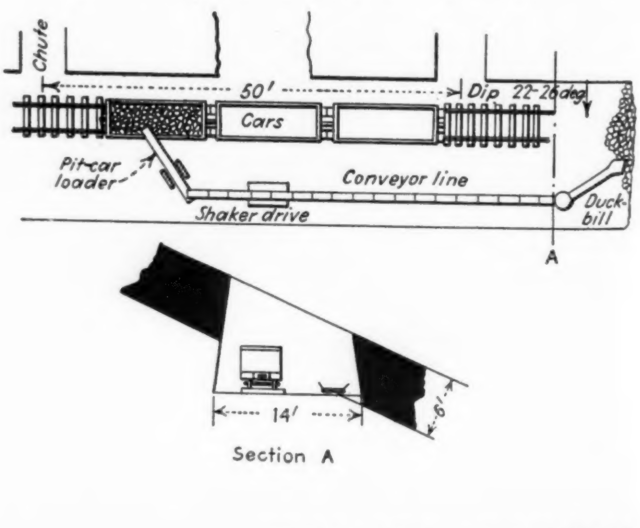
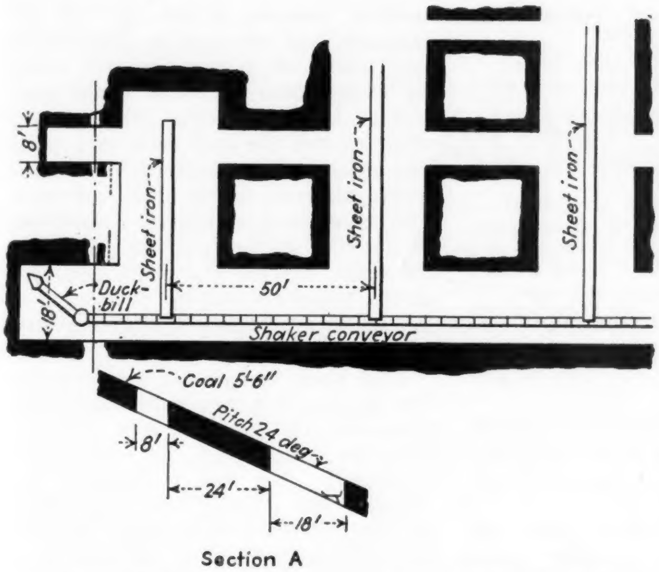



Fig. 5—Development of gangway in pitching beds.





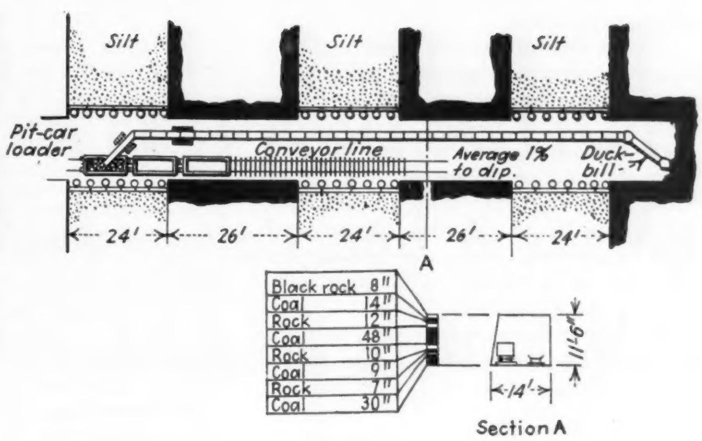




**Fig. 6—Development in shaker gangway with sheet iron in breasts. Fig. 7—Reopening silted area driving across pillars and chambers.**

As an example may be described an installation in a bed 5 ft. thick with an average pitch of 22 deg. The gangway is 14 ft. wide and 8 ft. high over the rail on the high side. An average thickness of 4½ ft. of bottom rock is lifted on the high side of the gangway, tapering down to nothing on the other side. The shaker conveyor is extended along the low side of the gangway, thus permitting the extension of the track and the unrestricted passage of cars to the face if desired. At the loading point, a pit-car loader is set at an angle between the cars and the conveyor to elevate the coal and rock from the discharge end of the conveyor into the mine car. The pit-car loader is used for this purpose because the top of the mine car stands 5 ft. high over the rail and much of the distance advanced with each set-up of the equipment would be lost if the conveyor discharged directly into the cars, thus tying up a certain length in which the necessary elevation would be gained in the conveyor line.

The crew consists of one miner and two laborers who drill, shoot and load the coal and rock. A transportation man spends part time at the loading point when the cars are being loaded. No timbering is required except when the roof is bad, in which case needed timber is set by additional men. When about 350 ft. of gangway has been driven, the equipment is moved up. It requires two 8-hour shifts to complete the move and be ready to load. The average advance of completed gangway, coal and rock for a period of 100 days of two shifts per day is 16 ft. daily, or 8 ft. per 8-hour shift. This is more than twice the rate of advance made in the same gangway with the same number of men per shift before the duckbill was installed. The sequence of operation is to drill, shoot and load one cut of coal. The duckbill is then retracted and the bottom rock is drilled, shot and loaded out. The various operations of the cycle for advancing the completed gangway a distance of 8 ft. in one 8-hour shift required the following division of time:

| | Hr. | Min. |
|---|---|---|
| Drilling, shooting, loading out one 8-ft. cut of coal | 2 | 15 |
| Drilling, shooting, loading out one 8-ft. cut of rock | 3 | 45 |
| Waiting on smoke, extending conveyor, extending air lines, etc. | 2 | |
| Total | 8 | |

Because the rate of development of the gangway is increased from 4 to 8 ft. per day, the number of breasts being worked on the gangway can be increased from four to eight. This concentration eliminates the maintenance, materials and haulage for one-half the number of gangways that would be required if developed by hand for any given tonnage.

*Example No. 5—Counter Gangways*—In several instances buggies have been replaced in counter gangways by shaker conveyors. Where new counters are being driven, duckbills are sometimes used. One interesting example, which is similar to counter-gangway work, is a shaker conveyor gangway in a bed of clean coal 5½ ft. thick on an approximately 25-deg. pitch. Because of the good roof, it was possible to drive the conveyorway 18 ft. wide. A shaker conveyor equipped with a duckbill was located along the low side. About a 9-ft. cut was shot off the solid and most of the loose coal would fall down the pitch to the low side, where it could be picked up by the duckbill. A crew consisting of one miner and two laborers drilled, shot and, with the aid of the duckbill, loaded the coal, advancing the development about 12 ft. per 8-hour shift. The work was double-shifted and the conveyorway advanced at the average rate of 24 ft. per day.

This conveyorway was driven a distance of approximately 900 ft. and two shaker conveyors were used in tandem in order to reach this distance. When the conveyorway was in its full distance, the duckbill was released for use elsewhere, but the shaker conveyors remained in place to be used as a main transport line for coal which was delivered to them over sheet iron from a breast above them. This method in pitching beds in some cases can eliminate expensive rock work and save the cost and installation of track equipment. Further economy can be effected in the highly concentrated mining accompanying breast operation.

*Example No. 6—Reopening of Flushed Areas*—In many locations, the territory has had to be flushed when the bed was first mined. Often, substantial pillars were left in these areas which under present conditions can be recovered. Sometimes, the reopening of such a bed through silted and caved ground for pillar recovery is a slow and expensive process. With the aid of duckbills, such an operation has been successfully performed in a bed from 10 to 12 ft. thick. The old gangway is so badly choked with broken timber, rock and silt that no effort has been made to reopen it and the new gangway is being driven at the upper side of the old gangway across the pillars and old chambers which are filled with silt and refuse.

This equipment is set so as to allow free passage of cars to the face, as cars are needed to facilitate the transportation and setting of such heavy timbers as are required. A pit-car loader elevates the material from the discharge end of the shaker conveyor into the mine car, thus permitting the conveyor trough line to be kept as nearly level as possible, in this way facilitating the rapid flow of the silt. It also permits

a maximum advance with each setting of the equipment.

A crew consists of one miner and two laborers. Average advance per 8-hour shift in the solid-shot coal is 8 ft., giving 15 cars of 90-cu.ft. capacity. The duckbill loads the silt without shooting with an average advance in the silt of from 8 to 10 ft. per 8-hour shift, giving from 16 to 24 cars of silt and rock, depending upon the amount of rock to be handled. The crew also timbers the gangway.

By the use of the duckbill, three times as rapid an advance was made as by hand loading, using the same number of men per shift.

*Examples 7 and 8—Development of Belt-Conveyor Gangway—Method No. 1, Taking Coal and Rock Together*—One of the problems connected with concentrated mechanical mining in thin beds is keeping the development work in step. In one highly mechanized anthracite mine, where the panel development must proceed at the rate of 25 ft. per day, duckbills are doing this successfully. In this mine all coal is transported by chain and belt conveyors. Belts are used in the gangways and shaker conveyors equipped with duckbills are used ahead of the belts to keep the development advanced. To gain time, coal and rock are shot and loaded together onto the belts, and the rock is separated outside the mine.

The development crew consists of one miner and two laborers. All work is double-shifted and in the two shifts of 8 hours each the completed conveyor gangway is driven a distance of 25 ft. This is an outstanding example of the speed attained in gangway development by the use of duckbills, and at this mine over 20,000 ft. of gangway has been driven as described.

When the gangway has been advanced a distance of 250 ft., the shaker conveyor is advanced and the belt conveyor is extended. The shaker conveyor is moved up in one shift by the regular crew of three men.

**Table I—Time Cycle on Average Day, 25 ft. Advance.**

*Day Shift (starts with clean place)*
7:00– 9:45—Drilling and shooting (twelve 9-ft. holes)
9:45–10:15—Clearing smoke and lunch
10:15–12:05—Loading cut and extending conveyor one pan length
12:05– 3:30—Drilling and shooting (twelve 9-ft. holes)

*Night Shift (starts with place shot)*
3:30– 5:45—Loading cut and extending conveyor one pan length
5:45– 9:00—Drilling and shooting (twelve 9-ft. holes)
9:00– 9:30—Clearing smoke and lunch
9:30–12:00—Loading cut and extending conveyor one pan length

The accompanying table shows a time cycle covering the two shifts on an average day in which the customary advance of 25 ft. was made.

*Method No. 2—Taking Coal and Rock Separately*—At another mine where the main transportation of the coal on the gangways is by means of belt conveyors the development of the conveyor gangway is accomplished by separate operations in the coal and in the bottom rock, being carried on simultaneously by two separate crews.

The bed is 34 in. thick, including a center band of 8 in. of bone, which is picked out at the face. In this mine the roof is good and it is possible to drive the conveyorway 30 ft. wide in the coal. Bottom rock averaging 36 in. thick is lifted 9 ft. wide to make headroom in the conveyorway. The bed pitches 15 deg. and the conveyor gangway is driven on the strike. The panel development must advance at the rate of 24 ft. per day, as the chambers that run parallel to the conveyor gangway advance two 6-ft. cuts per 8-hour shift, or 24 ft. per day of two shifts.

A crew consisting of one miner, two laborers and one cutting-machine operator advances the face of the conveyor gangway, in the coal only, two 6-ft. cuts per shift of 8 hours, or 24 ft. for the double shift. The cutting machine remains in the face of the gangway, and the coal is shoveled by hand onto a chain face conveyor which discharges onto a room chain conveyor. Along the lower rib this conveyor carries the coal back to a point where it can be conveyed by a short cross conveyor to the belt conveyor. The center band of bone is cleaned out of the coal at the face and gobbed in the space between the chain conveyor on the lower rib and the 9 ft. next to the upper rib, where the bottom rock will be lifted.

This work is followed at a convenient distance by a crew consisting of one miner and two laborers, who drill and shoot the bottom rock and load it with a duckbill. The shaker conveyor that operated the duckbill discharges onto the belt conveyor. Here again the work is double-shifted and in the two shifts of 8 hours each three 12-ft. cuts, or 36 ft. of advance, are made in the bottom rock. When the gangway has been advanced a distance of 250 ft., the shaker conveyor and chain conveyor are advanced and the belt conveyor is extended.

At this operation over 22,000 ft. of conveyor gangway has been driven as herein described. The time cycle of this work is given in Table II. It covers the two shifts on an average day in which the customary advance of 36 ft. is made in the bottom rock with the duckbill.

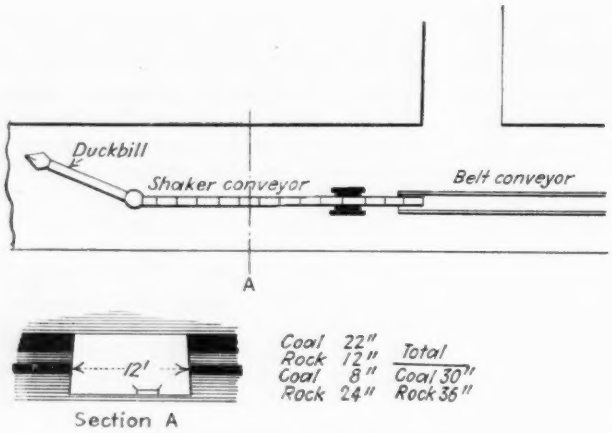



Fig. 8—Development in belt gangway—Method 1.

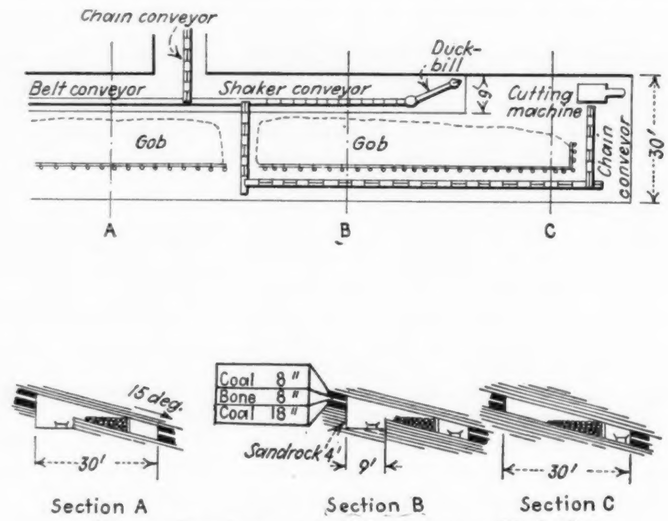



Fig. 9—Development in belt gangway—Method 2.

**Table II—Time Cycle on Average Day; 36 ft. Advance.**

*Day Shift (starts with clean place)*
7:00– 9:30—Drilling and shooting (three 12-ft. holes)
9:30–10:00—Clearing smoke and lunch
10:00– 1:00—Loading rock
1:00– 3:00—Drilling and shooting (three 12-ft. holes)

*Night Shift (starts with place shot)*
3:30– 4:00—Clearing smoke
4:00– 6:30—Loading rock
6:30– 9:00—Drilling and shooting (three 12-ft. holes)
9:00– 9:30—Clearing smoke and lunch
9:30–12:00—Loading rock

# ADEQUATE PROTECTION

## + Against Penetration and Freezing Major Problem in Shaft Lining

By A. W. HESSE
*Chief Engineer, Buckeye Coal Co.
Nemacolin, Pa.*

REALIZATION of the fire hazards inherent in the use of timber sets in shafts and slopes long ago induced many operators to seek non-flammable material for such construction. Concrete was widely employed, but subsequent disintegration of linings as the result of the freezing and thawing action of water brought much undeserved criticism upon the material. The real fault lay not with concrete as protective material but in the failure to so install it that water could not penetrate and cause disintegration.

Had brick been used without protection against water penetration, the same disintegration would have taken place where freezing and thawing were possible. A number of wood linings, too, have required replacements because of decay. Treated timber, it is asserted, will prolong the life of the wood to 20 to 25 years—which is longer than the lives of the concrete linings that failed. Unless the fire hazards are eliminated by fire-resistant salts, however, considerable danger exists. But, regardless of the material used, means must be found to prevent the destructive work of freezing water.

In a study of this problem, from data covering the last 23 years, it has been possible, by following through the history of certain installations, to reach certain definite conclusions. Water in any shaft is dangerous where freezing is possible. The cage may be jammed or the air movement may be cut down or completely stopped by the accumulation of ice. But, it is not necessarily the large flow of water alone that need give one concern, for experience has taught that the trickle goes on unnoticed, except when the ice accumulates. In the spring a little spalling takes place without attracting much notice. Finally, large chunks fall out, endangering the lives of the men working on the bottom, caging cars. This happened at the Brier Hill mine in Fayette County, Pennsylvania.

This shaft was sunk in 1904, lined with wood timber sets, lagged here and there, with lots of wood cribbing back of it at various places. In 1922, the condition became such that it was decided to concrete-line both shafts: the hoisting shaft, which was then an upcast, and the air shaft, then a downcast. The hoisting-shaft lining was completed before the Youngstown Sheet & Tube Co. took over the property in 1923. We later lined the air shaft with concrete, and shortly afterward, upon our electrification of the mine, reversed the air currents in order to keep the electrical equipment, such as haulage locomotives and pumps, etc., on intake air, thus making the hoisting shaft a downcast.

In the construction of this shaft, no efforts were made to hold the water back into the rock by grout; pipes were used to conduct it back of the lining where the concrete made solid contact with the rock, and in other places the water was permitted to flow down through the cribbing behind the lining; finally conducting it from the bottom by a pipe to the sump. As mentioned, it was not long before the trickles appeared on the surface of the concrete, as the drainage back of the lining began to fail; then followed the spalling each spring, until during the winter of 1930-1931 the superintendent clamored for a remedy. At the rate we were taking out the coal, the remaining life of the mine was but three years; therefore, the expenditure had to be kept to a minimum; fire hazards had to be avoided; and the plant was not to be delayed in its coal production. This reduced the methods to be employed to the following, which were adopted:

1. Knock off the scaly concrete, using two chipping hammers of the Ingersoll-Rand No. 57 type.
2. Trench each of the four walls of the shaft, from the elevation of the first leak down to the water ring, 240 ft. from the top; these trenches to be vertical, but to follow the contours of the faces, and to be made 6 in. wide and 4 in. deep, in which to place 4-in. galvanized gutter, the bottom of the gutter on the outbye side. Over this gutter and the trench lay or fasten welded-wire fabric.
3. Over these downspouts gunite with one part cement and four parts sand, thus covering the drains on the face of the lining. Continue the gunite to build up the face of the wall to somewhere near its original line. The leaks to be brought, by lateral drains of the same construction, over to the downspouts.
4. Use our own gunite machine and our own labor because of the limits to which we could go.

We had estimated that it would take 3,000 ft. of gutter, 5 rolls of wire, 40 bbl. of cement and 30 tons of sand. Working after the mine stopped hoisting coal, we would finish the job before cold weather again caught us by starting Aug. 1, 1931. Estimate of the cost was $3,962. Of all other schemes considered, the next lowest estimate came to about $6,325. Work actually started Aug. 19, and was stopped Oct. 16, at a cost of $3,118. That job did all that was expected of it and today still stands intact where completed and permitted the hoisting of coal without endangering men or equipment.

One coal company, in 1914, eight years after its shaft had been sunk, re-

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**• Because of some early failures, concrete linings for shafts and slopes received a black eye. Here, however, Mr. Hesse lustily takes up the cudgels in defense of the accused material. Much of the blame for the failure to withstand disintegration, he declares, should be leveled at the manner in which the concrete was used and the lack of preventives against the element—water—that caused its failure. After careful study of a number of installations, the author concludes that concrete lining is not only appealing from the standpoint of initial cost but that, if properly done, there should be no serious disintegration.**

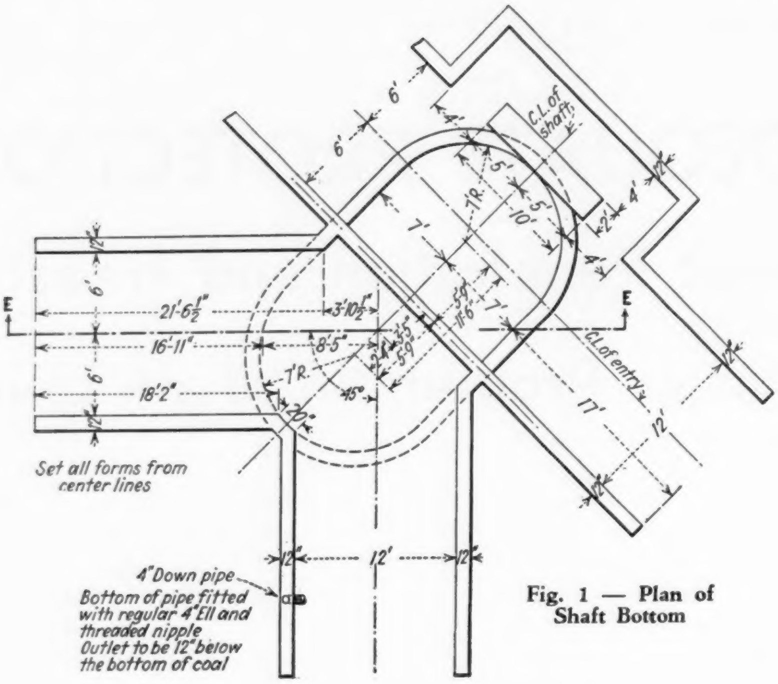



Fig. 1 — Plan of Shaft Bottom

quired cribbing and timber sets at the top, due to a landslide, to enable it to go on producing coal. Five years later this timber had so decayed that a renewal or a substitution was necessary. Concrete was employed in the upper portion of the shaft and reinforced gunite lining in the lower portion. The salient fact is that the shaft was extremely wet when work started and, except for moisture due to steam pipes and condensation, was relieved of this condition by conducting the water freely behind the lining to the bottom.

This work was completed in 1920, and at this writing the lining can be said to have proved very satisfactory. I am told that a little trouble is experienced at a few spots in the shaft, where the gunite was used, due to bulging, which is believed to have been caused by excessive quantities of débris having accumulated at those points. There is a little leakage through these bulges near the shaft bottom. Fortunately, this is an upcast shaft and the temperature does not get down to freezing. This same company, immediately after the completion of the above job, put a concrete lining in another shaft, and it has been most satisfactory.

Perhaps the first job could have been improved by grouting off the water as much as possible and saving the pumping expense all these years. The economics of this is illustrated by a shaft with which I had much to do. At its completion, the influx of water amounted to 60 g.p.m., and, although it was to be used as an upcast for the air with no danger from freezing, it was decided to stop or reduce this flow of water. The best that could be done was to reduce it to 2 g.p.m. after 47 days' work, drilling 363 holes to an average depth of 6.3 ft. and using cement only for the grout. The cost of this work was $3,583 and the savings, by reason of the reduced pumping, have since paid the first cost and 6 per cent on the money—and the savings still go on.

At our skip shaft, at Nemacolin, in the man-cage compartment, we had difficulty in grouting off the water leaks, after getting the flow down to mere trickles, but, this being an air intake, as well as a travelway for the cage, our experience taught us that dire consequences would follow if something was not done to prevent collections of ice and spring thaws. Every effort to drive this water back into the rock failed because we could not get a stopcock that would work perfectly in holding the last drop of water from leaking through it, and that one drop of water meant defeat. We even tried using asphalt in place of grout.

Before starting the work we experimented with samples to be sure that we got the right melting and solidifying properties in this material. Heating equipment and a Cameron pump, altered to give us at least 250 lb. per square inch pressure, were set at the top of the shaft. In order to keep the asphalt in a fluid state until it entered the hole drilled through the lining and into the rock, an electric current was sent through a wire in the pipe conveying the asphalt. Two grades of material were used, the one grade for the final plugging solidified at 60 deg. F. and another of somewhat softer consistency solidified at 50 deg. F. to force back into the small spaces. The latter was used first. While the asphalt worked as well as cement grout in closing off leaks, it was much more difficult to work with. As this work started Oct. 16, it was not long until cold weather caused cessation along this line.

The men employed on both the grouting and asphalt work were experienced shaft sinkers and well trained in the use of the grout machine, but the importance of drying the face of the lining to the last trickle had not been impressed upon them by shaft contractors; a shaft lining was ordinarily declared dry at a gallon or two influx. In 1927, we were given permission to spend the money to trench the walls of the shaft deep enough to face the trenches with brick and leave space to conduct these leaks down behind the brick to the bottom of the shaft. This work occupied about three months, since which time our troubles have practically ceased.

Our slope was treated likewise, starting in August, 1927, but it was a much larger job and was not finished until the spring of 1928, as there are two compartments and the upper deck has an arch, in which the leaks had to be bricked in on a curve overhead, requiring more or less forming. These trenches were carried down the sides to the floor of the bottom compartment, then along one side, just above the floor, the full length of the slope to the bottom, where the water is conducted into a sump. In no event is the air permitted to enter these conduits anywhere, even at the discharge points. In other words, the air is sealed off and we have yet to experience a freeze up in any of these trenches.

When we sunk the auxiliary air shaft, which is an intake at the south side of our property, no downspouts were put in, and we tried to grout off the leaks with cement, and thought we had a good job. It was a good job, all but one section, which must be renewed.

The next shaft we sunk, where the No. 2 fan is located, we grouted the rock when we struck water before proceeding with the sinking or placing of the concrete lining. We also put in a water ring and conductor pipes in the lining from the top of the shaft to the bottom, but these pipes are located 6 in. from the face. At the bottom the pipes are all brought together and connected to a pipe line that, with the head that builds up in the downspouts, carries the 20 g.p.m. of water 1,000 ft. to a pump station.

During the winter of 1935-36, two or three tiny leaks in this lining developed into serious influxes of water, and considerable ice had to be removed from the bottom of the shaft during the cold spell and, when the weather became mild enough to make an inspection of the lining, two serious situations were found, requiring repair before the next winter season. A headframe was erected, and the work platform consisting of three gratings along the side walls left ample airway. Air also could

pass through the gratings. Suspended from the coping by three ropes attached to crab reels, the platform could be moved from point to point.

After work actually started, it was found that there were other points in the shaft lining indicative of water leaks and these were repaired, as well as the two major leaks. The water ring at a depth of 97 ft. was cleaned out as well as the downspouts. All of these leaks were trenched to the downspouts and the openings bricked over so that the water could flow freely to these downspouts. Only two or three men could work in the shaft with efficiency, and the entire crew consisted of but one foreman and five helpers. The entire work covered a period of but six weeks, and at the completion of the job not a drop of water was flowing into the downcast of the shaft.

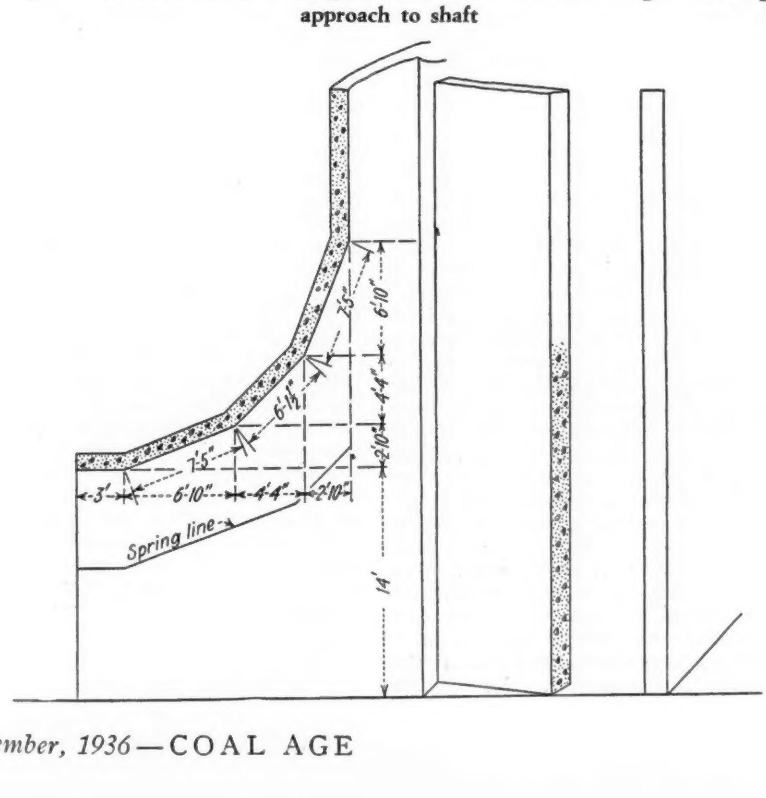
Another shaft, not our own, sunk in 1906 was making 600 g.p.m. until concrete lined (reinforced in 1913, and grout forced back into the rock until influx of water, through the lining, reduced it to about a quart. Twenty-two years has now passed since that job, with considerable saving in the pumping bill, and the lining no doubt has paid for itself many times over. The air shaft was also concrete lined and has stood the ravages of time well.

There has been some seepage in the hoist shaft and, on account of this shaft being the air intake, it has had some ice collections and some disintegration of the concrete, but not of a serious nature. The management of this mine feels that the concrete was saved by the water breaking into the mine 1,000 ft. from the shaft, thus relieving the pressure on the lining. A similar job was performed in a shaft 4 miles from the one just mentioned, about 25 years ago, and the water penetrated the lining with subsequent freezing and thawing until in places the concrete is entirely off.

Brick veneer, backed by concrete, has been and is being employed with satisfactory results. The R. G. Johnson Co. informed me that vitrified brick linings they put in 10 years ago are still in perfect condition. "Particularly is the brick-lined shaft superior in a hoist shaft where there is water splattered from wet coal cars." One advantage claimed for brick lining with a concrete backing is that its method of placing allows of broken joints between the brick wall and the concrete; and the pores or voids in the mortar of the brick are closed by the fine cement aggregate of the concrete. The joints in the sections of concrete, where concrete only is used, are the difficult places to seal off effectively.

Other means have been resorted to in the effort to prevent the build up of ice in hoisting shafts by cutting off flows of water, one of which is to drill holes as close as possible to the lining and insert 8-in. pipes perforated with ⅜-in. holes to hold back disintegrated rock, still permitting the water to flow into the pipes. This method has been tried, sometimes using two pipes and in other cases using four holes to drain the water away from the shaft. Most of these holes are still effective after twelve years' service and two holes have ceased to function. The choice of this method no doubt is influenced by the quantity of water that will have to be pumped after it reaches the bottom. At Nemacolin we struck a stream alongside our skip shaft with a borehole that flowed about 200 g.p.m., but the borehole was

**Fig. 2—Elevational section along cross-sectional line E E in Fig. 1 showing approach to shaft**



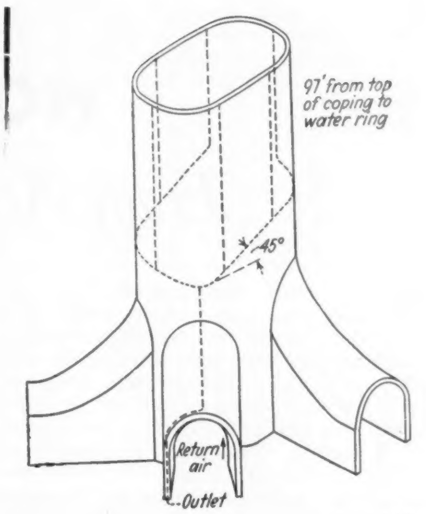




**Fig. 3—Shaft exterior elevation with piping system to remove seepage water**

not for the purpose of drying the shaft lining. It illustrates a case where it would have been folly to pump this much water to keep the pressure off the lining.

Study of the cases cited lead to these conclusions:

1. A shaft can be sunk and concrete lined without the serious disintegration that has taken place in so many cases.

2. The use of a brick facing backed with concrete no doubt improves the construction, but costs more.

3. In the sinking, or excavation, when water is encountered, drive as much as possible back into the rock by grouting, whether by the use of clay and dehydral, cement or whatnot, just so the placing and setting of concrete is not disturbed.

4. When the concrete lining is poured, use a 1 : 2.4 mix and the proper quantity of water. We poured our last lining with concrete slumps of 4 to 7 in. without any difficulty. Vibrators are now used very successfully to improve the density of the concrete behind the form just after pouring.

5. Place 4-in. galvanized downspouting in the lining, at not over 6 ft. centers, within 2 in. of the face of the concrete for immediate drainage and for future conductors of those trickles which cannot be shut off by grouting back of the lining. This is contrary to the usual practice.

6. Grout off all the water influx that is possible after the lining is placed, and any visible leaks that cannot be stopped conduct into the downspouts; of course, sealing off the air when doing so, at both top and bottom.

7. Gunite is suggested only as a means of repairing damaged spots difficult to work at and the conditions such as experienced at Brier Hill. There always is a question as to the obtainable density and subsequent hair cracks, which make the job pregnable to moisture and freezing attacks.

# NOTES

## *From Across the Sea*

HEAT from underground fires and from explosions which result from such fires raises the question whether breathing-apparatus men working in open mine workings or behind seals should be provided with special clothing for such work. An article by G. L. Brown, Heriot-Watt College, Edinburgh, Scotland, read before a general meeting of the Institution of Mining Engineers, illustrates forcibly the value of such colleges for study and research apart altogether from the education of students.

Experience with asbestos clothing has proved it unsuitable for such work; conditions are entirely different from those existing at surface fires, but some means should be devised to enable men to penetrate to the seat of a fire, so that they can fight it directly or position monitors for directing water upon all parts of it. Mr. Brown declares that when the wet-bulb temperature exceeds blood heat, no clothing can be worn with comfort for more than 20 or 30 minutes because body temperature begins to rise. Asbestos clothing soon attains the temperature of the surrounding air and conducts heat readily to the body and also to the air on its way through metal pipes to the lungs of the apparatus men. If, however, it is used with a lining of other material, the added weight increases the discomfort.

Being a better and lighter heat insulator, wool flannel occasions less discomfort than asbestos. Ordinary trousers and a wool shirt give maximum ease, especially at wet-bulb temperature above blood heat and at dry-heat temperatures of 120 to 130 deg. F., but, with the dry bulb at 200 deg. F., a wool flannel hood and gloves are needed or the skin will be scorched, and the face will be burned wherever metal parts of the apparatus are in contact with it. The late Dr. J. S. Haldane stated that "when working at a wet-bulb temperature above blood heat, one should put on a lot of clothes to keep the heat out."

At high dry-bulb temperatures, the discomfort caused by both dry and moist inspired air occurs before discomfort due to rise in body temperature, and this, combined with a checking of the pulse rate, warns apparatus men that heat stroke is so imminent that they should withdraw from the work. Where the external wet-bulb temperature exceeds 96 deg. F. or where the dry-bulb temperature exceeds 120 deg. F.—the first because of excessive body discomfort and the second because of the dry or moist air caused by the nature of the absorbent used and because of the heating of the air in metal pipes and "coolers"—operations with breathing apparatus, according to Mr. Brown, should be confined to light work of not more than 20 or 30 minutes' duration. Caustic-soda absorbent causes dry throat, and soda-lime gives a hot, moist air which scorches the throat. The latter occurs earlier than the former and causes the greater discomfort.

An explosion of gas in July, 1934, when attacking an underground fire, burned the apparatus men and other workers who were fighting it. Apparently, they were not burned by fire but only by the hot gases resulting from the explosion and were not burned at all where ordinary clothing properly covered the body; the most severe burns were those of the exposed hands, face, neck, chest and arms. If a woolen hood and gloves had been worn and the other exposed parts been covered, the burns would have been trivial if not entirely prevented. Neither clothes nor apparatus was even scorched. Those who wore apparatus were protected front and back by leather parts.

Mr. Brown concludes by saying: Gauntlet gloves are desirable to keep hot air from being blown up the sleeves. A strap around the trousers at each ankle or the socks brought up around the trouser ends would prevent hot air from being blown up the legs. Hard hat and knee pads would give added protection.

It might be added in comment that men are scarcely likely to be burned on the legs, for that is not where burning methane and hot gases usually travel. Wool, where the fire does not reach it, is safe, but, if it should become inflamed, it spreads fire rapidly and is extinguished with difficulty. Coal fires have no flying embers, and even timber, bark and caps, where men are working on the intake, provide none so long as the men do not pass any part of the fire. It would seem that, working on the return, wool might be dangerous. Especially would this be true if there were an explosion with actual flame projection to points where the men were working and whether on the intake or return, but it is doubtful if in that case they could survive even if clad in asbestos all over.

EDITORIAL comment in this publication has urged that solid fuels are more efficient than gas fuels because of the radiant heat emitted by the former. Much of the heat of gaseous fuels is of low radiance and passes up the chimney, unless large absorptive areas are provided for its retention. It is interesting to note that Captain Harry Crookshank, Secretary for Mines, answering Graham White, a member of Parliament, declared that, "under suitable and similar conditions, a good low-temperature fuel should radiate not less than 25 per cent more heat than an equal weight of good household coal."

This fact is making miners less ardent for the development of this type of fuel, which seems likely to be so much more efficient than raw coal that its manufacture will not add to the number of men employed to the great extent which a mere calculation of the thermal contents of the two fuels had suggested. Mr. White asked "if it did not appear from that reply that the optimistic hopes of greater production of coal would be somewhat less than anticipated," and Captain Crookshank admitted that "he thought that there was, perhaps, much unfounded optimism as to the quantity of coal that would be required" if all the coal were submitted to low-temperature carbonization. It seems that semi-coke has a value not alone expressible in smokelessness but also in heating efficiency. The same doubtless is true of anthracite, at least in a degree.

Captain Crookshank declared that applying the factor of 25 per cent to the average production of low-temperature semi-coke per ton of coal processed, about 2,100 lb. of coal would be needed to produce low-temperature fuel which would yield the heating value of 2,000 lb. of coal. This would give an extra requirement of about 5 per cent of coal. If the gas produced at low-temperature works were sold for industrial or domestic purposes, this would, if competing with town gas or coal, diminish the quantity of coal required.

AT SHAFT II, of the Bonifatius coal mine, at Kray, Prussia, is what is said to be the world's largest and most efficient mine elevator, which will raise or lower 70 persons at one time. The 3,900-hp. d.c. motor can make 36 trips hourly with an effective load of 15½ short tons (14 metric tons). It travels at a speed of 49.2 ft. (15 m.) per second, or 33½ miles per hour. A 2.4-in. (65-millimeter) diameter wire rope with a tensile strength of 6,059 lb. per square inch (173 kilograms per square millimeter) supports the cage.

A SURVEY made by the mineral resources department of the Imperial Institute of Great Britain shows that the average royalty paid at British mines is 9.71c. per short ton, based on salable coal after deductions for colliery use, but inclusive of way-leaves, which are payments for the haulage of coal over the property of others. The gross royalty paid is about $25,000,000 annually The average royalty exclusive of way-leaves is 9.15c. per short ton. These royalties may be a fixed cost per ton, a fixed sum per acre, a fixed sum per foot-acre, a cost based on the price per ton or per acre above or below a certain datum, or a fixed minimum cost per ton, with a sliding cost varying with the average selling price of the coal. Rates for individual collieries vary between 4.46c. and 26.78c. per short ton, the latter being exceptional.

ON THE AUTHORITY of Dr. Nagel, of Dresden, as voiced at a recent meeting of the Association of German Engineers held at Darmstadt, Dr. Rudolf Pawlikowski's coal dust engine is successful. Dr. Pawlikowski is an old-time assistant of Diesel; his engine is constructed by the Schichau plant at Elbing. A series of trial runs has been made to ascertain its practicability for heavy-duty use, and it is said to be ready for commercial-scale production. The test engine is a single cylinder of 21½-in. (550-millimeter) diameter and 25½-in. (650-millimeter) stroke. It delivers 200 hp. at 180 r.p.m.

Coal dust is fed to the combustion chamber without compressed air, and uni-

formity in its delivery is assured by a special airless injection developed by the Schichau works collaborating with the machine-construction department of the Higher Technical School of Dresden. Hard cylinder sleeves and piston rings reduce abrasion to a degree "commercially bearable." Herr Pawlikowski's first engine was developed in 1916. The I. G. Farbenindustrie at its Oppau plant is said to have tried from 1924 to 1930 to develop a coal-dust diesel that would not conflict with his patents, but without success.

The engine operates in four cycles and has a preliminary chamber into which, through a sleeve valve, the fuel is sucked during the intake stroke. At the completion of this stroke, the fuel is shut off, and a gust of pure air blows the intake valve free of dust, thus insuring its effective closure. On the compression stroke, the fuel in the preliminary chamber is partially gasified; an explosion in that chamber promptly follows, ending with complete combustion in the main cylinder.

Other fuels than coal can be utilized: wood, flour, waste lignin from manufacture of pulp, sugar, powdered dry foliage, corn cobs, pine needles, copra, cocoa and coffee hulls, and residues from vegetable-oil manufacture.

R. Dawson Hall

# *On the* ENGINEER'S BOOK SHELF

***Orders for all books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case is in the review notice.***

*Theory and Practice of Mine Ventilation, by W. J. Montgomery. Jeffrey Manufacturing Co., Columbus, Ohio. 285 pp., 5x7¾ in.*

Simplicity of presentation with wide coverage of the subject marks this new publication on fans. Mr. Montgomery knows the ventilation field from A to Izzard from actual contact with the field; knows what is known and misunderstood, what it is necessary to know to get results and has no use for formulas, except when they are absolutely necessary to enable the facts to be understood. J. A. Saxe has collaborated with him in discussing regulators and altimeters.

Mr. Montgomery is frank in saying that only rarely is a new fan as desirable as a better airway-provided mine. All the fan does is to raise pressure of a certain quantity of air per minute. Then, if with that pressure the mine will carry that air, everything will be well, and the fan will be regarded as a splendid ventilator; but if the airways will not carry that quantity of air with that pressure, then the fan will be rated very low in the eyes of the operator, which is, of course, ridiculous. Air conductors, or airways, like electrical conductors and like water conductors, or pipes, must be adequate, or no fan will give the air needed except at an excessive pressure and an enormous power bill.

Mr. Montgomery thinks they do things better abroad. In some ways they do, but their high water gages prove they have, in some ways, more to learn than we have, but they are learning and so must we.

The author would have the fan user limit himself to 3-in. water gage, air speeds everywhere not exceeding 2,000 ft. per minute, and then for not over 500 ft. with at least 75 per cent of the air going all the way to the face. Says he: "Since the fan hauls a vast tonnage of air through the mine each day, every precaution should be taken to provide a good bed over which the air is hauled. Sharp turns and high velocities must be eliminated, and sides, bottom and top kept as smooth as possible." The author gives simple formulas; states just when a new fan is needed; discusses briefly mine gases, mine moisture, overcasts, stoppings and rock-dusting; gives a section to booster fans, auxiliary blowers and air measurements; then discusses large fans and how to measure their efficiency; presents the arguments for and against exhaust and blowing fans, advocating their reversibility, and finally sets down the principles of fans in series and parallel. Everybody interested in ventilation will find this book useful—and understandable.

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*The Inflammation of Coal Dusts: The Value of the Presence of Carbon Dioxide and Combined Water in the Dusts, by T. N. Mason and R. V. Wheeler. Safety in Mines Research Board, Paper No. 96, 10 pp., 6x9½ in. British Library of Information, New York City. Price, 20c.*

This technical paper extends the information contained in S.M.R.B. Paper No. 79, stating that "it has been found that the efficacy of an incombustible dust as a suppressor of inflammation can be related to its contents of carbon dioxide (for example, as carbonate in limestone) and of combined water (for example, as hydrate in gypsum)."

A footnote is intriguing. "Certain chemicals—for example, the chlorides of potassium and sodium—are considerably more effective in suppressing the inflammation of coal dust than can readily be accounted for on the assumption that they merely absorb heat. It would appear that such chemicals have a specified action in inhibiting the combustion of coal dust (just as iodine vapor inhibits the combustion of methane). That action is not properly understood, but it is being studdied, together with the parallel problem of the apparent enhancement of the inflammability of coal dusts by some compounds (for example, sodium carbonate)."

Salt already has been used (1) to prevent explosive dust from being raised, (2) to improve roadways for travel and (3) to hold water as against an explosion. It has not been too favorably regarded, but here is a suggestion that, apparently apart from its holding water, it has a specific inhibiting effect on combustion. However, it is less desirable because it binds itself from being raised in the face of an explosion as does gypsum and also binds incombustible dust either by caking the dust if dry or by wetting it if saturated.

The figures used are derived from experiment with the 4-ft.-diameter explosion gallery at Buxton Station, England, using coal dusts and incombustible dusts 80 to 85 per cent of which will pass through a 200-mesh I.M.M. standard sieve. Plotting the results, it is shown that for Silkstone coal dust, 56 per cent of combined carbon dioxide (if it could be obtained) would be as effective as 65 per cent of residue free from carbon dioxide. Weight for weight of coal dust rendered "uninflammable" therefore, the efficiency of carbon dioxide relative to that of residue is 1.45 to 1 in this case and with Red Vein coal dust is 1.35 to 1.

Quantitively 21 per cent of combined water is as effective as 63 per cent of anhydrous residue or 1 per cent of water is equivalent to about 3 per cent of anhydrous residue in the case of Silkstone coal. Weight for weight of coal dust "neutralized," therefore, the efficacy of water as hydrate relative to that of the anhydrous residue is about 7 to 1. With Red Vein coal dust it is 6.5 to 1.

The reviewer is somewhat pleased with this result, for in *Coal Age*, Nov. 25, 1911, pp. 206-207, he urged that materials containing combined water and combined carbon dioxide might have preference over materials without either or only a little. Private comment of competent chemists was that the time of inflammation was so short and the heat not sufficiently intense to produce dissociation; hence flammation would be equally inhibited by all incombustibles almost regardless of chemical constitution. It was in 1915-1916 that A. S. Blatchford published his experiments on the "quenching" effects of a number of incombustible dusts on the flammation of coal dusts.—R. Dawson Hall.

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*Transactions, Coal Division, American Institute of Mining and Metallurgical Engineers, 1936. 512 pp., 6x9¼ in.; cloth. Price, $5 net.*

Containing articles prepared for the State College (Pa.) meeting of October, 1934; that at St. Louis, Mo., October, 1935; and those in New York, February, 1935 and 1936, this book contains 25 separate treatises on underground mining, beneficiation and utilization, research and classification, economics, flow of gas through coal, health of employees, geophysical prospecting and geology. All the addresses published have been selected by a board of engineers for their timeliness, value and originality, so that they represent some of the most recent thought of the coal industry along the lines indicated. With the exception of the article by Graham Bright on underground lighting, none has reference to mine equipment.

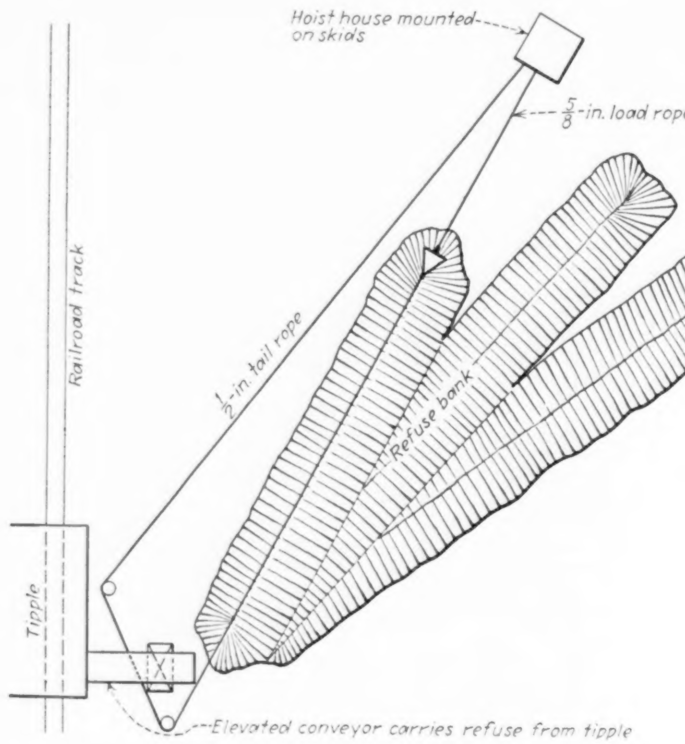
# OPERATING IDEAS

## *From Production, Electrical and Mechanical Men*

### Semi-Portable Hoist Cuts Refuse-Disposal Cost

Refuse-disposal cost at Walhonding No. 2 mine of the Cambridge Collieries Co., Guernsey County, Ohio, was cut in half by eliminating track-and-car haulage and substituting a drag scoop unit. Although the refuse is burning continuously at the end of the pile where it is deposited by the scoop, rope life is not shortened to a marked degree by the heat and other detrimental effects of the fire.

For the most part the equipment was assembled from spare machinery available at the mine. The plan of operation is indicated by the accompanying illustration. With this arrangement, whereby the electric hoist is situated so the load is pulled directly toward it, the load rope is shortened, therefore is less costly, and is not subjected to the wear of operating over a tail sheave, as would be the case if the hoist were at the tipple. Scoop loads average 1½ tons and the total disposal per day approximates 70 tons.




**With this movable hoist, the load rope has a straight pull and is relieved of sheave wear**

### Concentric Cable Suspension Reduces Borehole Cost

At mines of the Old Ben Coal Corporation in southern Illinois, money was saved on the drilling and on the casings and cables of borehole feeder installations by adopting concentric cable instead of two single cables for 275-volt d.c. connections from surface substations to underground distributions. Formerly an 8-in. casing was used for a 2,000,000-circ.mil circuit; now a 4-in. casing suffices for the same capacity.

The concentric cable is built to practically the same specifications as a steel-wire armored cable. The only difference is the use of hard-drawn copper instead of steel for the armor. These copper armor wires, having a total area of 2,000,000 circ.mil, support a large percentage of the cable weight and also act as the negative conductor. Two such cables have been installed; the first was put into service four years ago at Buckner air shaft and the second two years ago at No. 18 mine, near Johnston City.

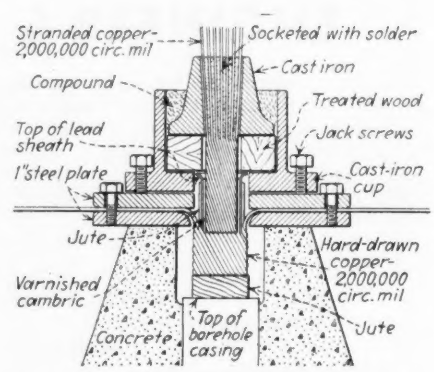
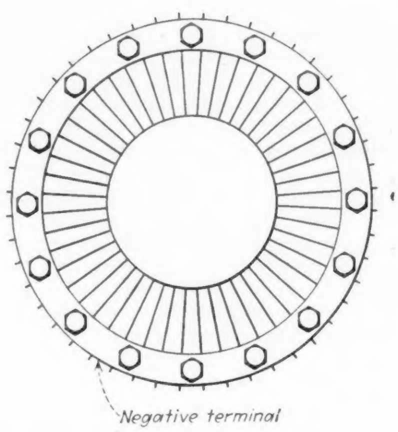



**Fig. 1—Weight is divided between the center conductor and the copper armor**

In both instances surface suspensions take the entire weight of the cables and the longest cable thus suspended is 500 ft. Fig. 1 indicates the suspension arrangement whereby the armor wires are clamped between horizontal plates and the core conductor is socketed into a cast-iron socket. To provide an adjustment for making the core conductor carry at least a part of its weight the flange of the cast-iron cup is fitted with jackscrews.

Treated wood constitutes the annular compression spacer and insulator between the cast-iron socket and flanged cup. Although in this drawing the cable is shown as having a jute covering over the copper armor wires, that covering was omitted on the cable of the second installation.

Another change in the second installation was the method of assembling and connecting electrically the individual wires of the copper armor beyond the horizontal clamping flanges. In Fig. 2 the upper of the two schematic drawings shows the clamping ring connector of the first installation. The lower drawing indicates the method of the second installation whereby the wires were



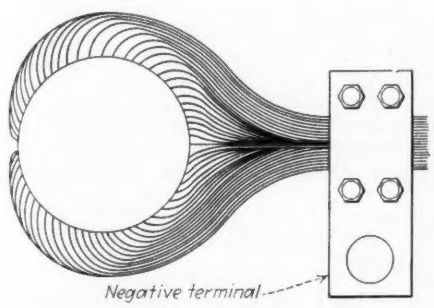




**Fig. 2—Assembling the copper armor wires into a bundle for electrical connection, as indicated by the lower figure, is now preferred to the clamping ring arrangement of the upper figure**

carried around to one side to form a bundle which is clamped by a terminal connection fitting.

Varnished cambric insulation of a special design to prevent slipping is used on these concentric cables, and lead is used to protect the insulation from moisture. The suspension was manufactured by the General Electric Co.

The cost advantage of the concentric cable is further increased because lowering it into position is a less troublesome job than was lowering the two smaller cables formerly used, one a lead-and-armor positive and the other a weatherproof braid negative.

## Short Axe Handles Safer

Axes used in shaping wedges, stakes, cap pieces, etc., should have oval handles not over 18 in. long, writes one anthracite mining man after reading of the M-S-A hand guard in the August, 1936, *Coal Age*, p. 352. The oval handle provides a better grip and keeping the length down to 18 in. is an excellent method of preventing injuries due to the handle catching in the clothing or striking the rib, cars, machinery or other objects. Where a long-handled tool is needed for driving cap pieces or in other work of a similar nature the workmen should be provided with a light sledge hammer, thus removing the temptation to fit long handles into axes to be used for both cutting and driving. With the short-handled axe, sledge and hand guard, maximum protection will be afforded men engaged in timbering and other duties requiring use of an edged tool.

## Welded 40-lb. Frogs Used At Talleydale Mine

All-welded No. 2½ frogs are standard for 40-lb. track at the Talleydale mine of the Snow Hill Coal Corporation, Terre Haute, Ind. Developed by A. K. Hert, shop foreman, these frogs require one piece of steel plate and five lengths of 40-lb. rail (see Fig. 2). To form the wings, two 38-in. lengths of rail (*A*, Fig. 2) are marked off and bent to shape in a handpress. To facilitate bending, the base is split or cut out, as the case may be, with an oxyacetylene torch. Bands are made hot. Final shape of the wings is checked with a steel templet.

**Fig. 1—Completed all-welded No. 2½ frog**

Rail lengths *B* and *C* used in constructing the point are beveled off and cut out so that they can be arc-welded together. The point then is cut back, or "blinded," so that the wheel will pass it on either flangeway without striking the point and derailing the car. After the point is assembled, it is finished by grinding, laid on the baseplate and tacked in place. The wings then are placed on the plate and the flangeways of the wings are lined up with the flangeways of the point, with just enough space between the rail bases to permit running a welding bead, after which the wings are tacked down. Points and wings then are welded to the baseplate, a bead being run along the bases of all the rails making up the wings and point.

All 40-lb. track at Talleydale is laid with standard steel ties with inside movable clips, except for four special ties under the switches in each turnout. Connections are made with splice bars, which permit the use of ties directly under the joints in all cases where it is desired, including frogs. One point rail is made 10 in. longer than the other, which throws the joints in front of the frog apart and further facilitates the installation of the ties at these points. Although wood ties are not used under 40-lb. track at Talleydale, the long point rail is stated to be particularly advantageous in this service, as it allows the joints to be placed on separate ties, thus eliminating excessive spiking, particularly near the end of the tie, and making a stiffer installation around the frog. An experienced man can build a frog of this type in two hours.

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# No Let-Up

**• Running a coal mine requires constant attention to a thousand details, as well as a continuing search for better methods of performing the normal tasks involved in getting out the coal. Also, operating, electrical, mechanical and safety men must meet the unusual problems that arise from day to day. To help them discharge both routine and emergency duties more efficiently, this department presents each month a selected list of ideas originated throughout the country by the men on the firing line. If you have such an idea, this is the place for it. So send it in—with a sketch or photograph if it will help to make it clearer. For each acceptable idea we pay $5 or more.**

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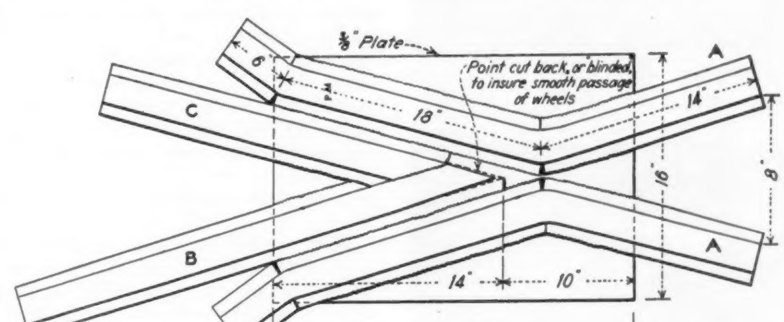



**Fig. 2—Details of all-welded No. 2½ frog used on 40-lb. steel-tie track at Talleydale mine**

# Working Hints From a Shopman's Notebook; Rebabbitting Jig and Many-Duty Puller

By WALTER BAUM
*Master Mechanic, Perry Coal Co.
O'Fallon, Ill.*

JIGS of the type shown in Fig. 1 have been quite convenient at times when it has been necessary to pour a bearing in a hurry. In the size shown, for rebabbitting a 4 15/16-in. bearing, the jig is made of two mild-steel plates ½ in. thick and 12 in. long (or long enough to allow a ⅝-in. hole to be drilled in each end of the plates far enough apart so that a bolt will pass the bolts used to hold the top half in place) and 7 in. wide. The plates then are clamped together and the ⅝-in. holes are drilled, after which the plates are fastened together by short bolts and placed in the lathe chuck to be bored out 1/64 in. larger than the shaft on which the jig is to be used, thus permitting the plates to slide on the shaft after it has been warmed.

After boring is completed, the plates are center-punched about 1½ in. from each end on what is to be the bottom side, and then are drilled with a 5/16-in. bit 1¼ in. deep. The holes are tapped with a ⅜-in. USS tap and a ⅜-in. capscrew with threads down to the head is screwed in each hole. These capscrews are for raising and lowering the shaft to permit the bearing to be poured level. A piece of cardboard is placed between the bearing and the plate on each end. Then two bolts are placed in the ⅝-in. holes and the plates are drawn up tight.

When pouring only the bottom half of the bearing, a spacer to take the place of the upper half can be made by using a bolt and a piece of pipe. The nut on the bolt should be run down as far as possible and the pipe placed over the threads and against the nut. Then, by placing the head of the bolt against one plate and the pipe end against the other and unscrewing the nut, the plates can be prevented from tilting and very little mud will be required to keep the hot metal from running away. After the bottom half has been poured and the top half is in place ready for pouring, a 3/16-in. strip should be cut out of each piece of cardboard from the top of the shaft to the top of the card to allow ventilation.

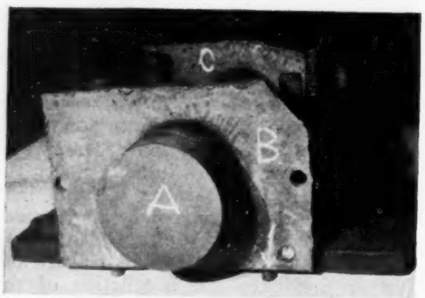



Fig. 1—Jig in place on a shaft, showing construction details

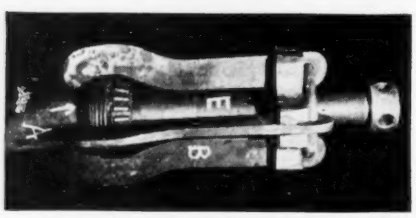


Fig. 2—Puller operating on a roller bearing

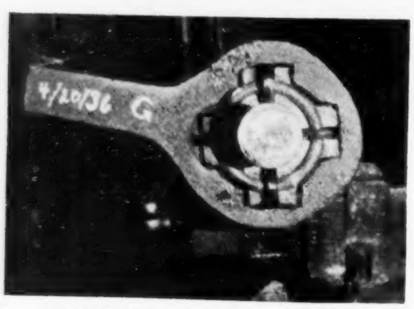



Fig. 3—End view of puller with holder in place

Ease of construction and a wide range of uses are the principal advantages of the bearing and gear puller shown in the accompanying illustrations. No pins or bolts are required to hold the hooks in place. Groups of hooks of different shapes can be made to fit various gears and pulleys and each group always will remain intact when once assembled and the ring welded. To change sets of hooks, the puller is turned upside down to allow the hooks to slip over the screw.

The puller nut, *D* (Fig. 4), is made of a piece of steel 1½x6½x6½ in. centered and placed in a lathe chuck and bored and threaded to fit screw *C* (Fig. 6). While in the lathe chuck a circle 3½ in. in diameter was made on the face of the nut with the lathe tool. The straight lines from side to side were inscribed as shown. At the intersections of the lines and circle, four 17/32-in. holes were drilled after the nut was removed from the lathe chuck. To complete the nut, it was carefully cut with a torch along the dotted lines (Fig. 4).

Four hooks next are made in the desired shape. Fig. 5 shows the shape used to pull roller bearings. Each hook has a 21/32-in. hole punched in the top end. Holes are punched for greater strength. Hooks made by myself were constructed of ½x1⅞-in. steel. A ring of ⅝-in. round steel was bent to an inside diameter of 4⅞ in., and, after installing the hooks, was welded shut.

The puller screw was made (first) of

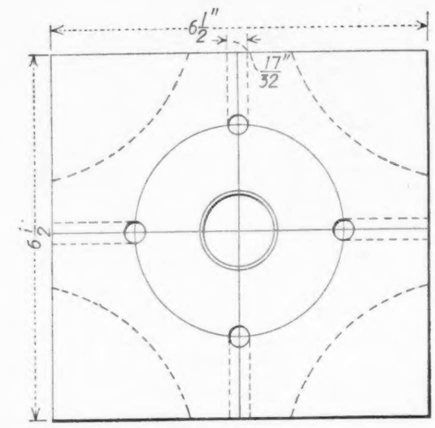



Fig. 4—Showing how puller nut is made

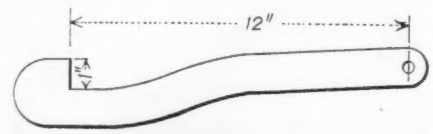



Fig. 5—Details of hook for roller bearings

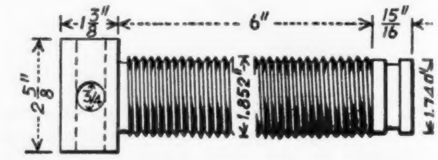



Fig. 6—Construction of puller screw

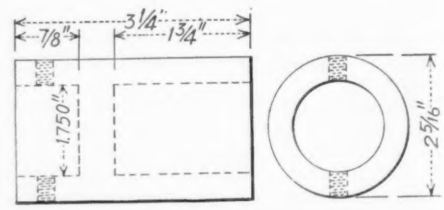



Fig. 7—Details of thread protector

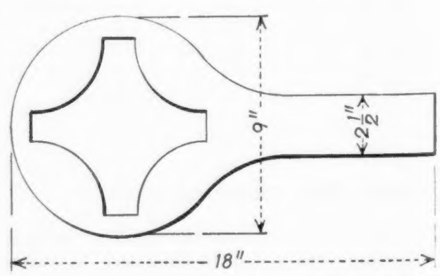



Fig. 8—Construction of puller holder

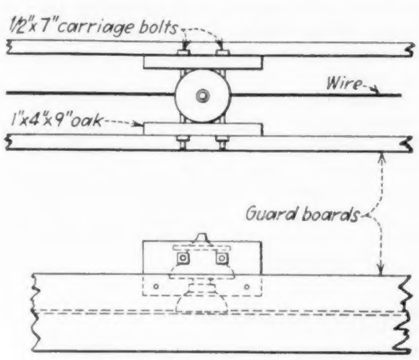
a piece of 2¾-in.-diameter heat-treated steel turned as shown (Fig. 6) and cut with No. 10 USS threads. Two ⅜-in. holes, which cross each other, were drilled through the top of the screw to permit the use of a pointed bar in turning the screw. The thread protector (Fig. 7) should be made of heat-treated steel with the end fitting over the threads bored out to the desired size. Many different kinds of protectors can be made; for example, some will enter a hole when pulling a gear or pulley. Two hollow set-

screws are used to hold the protector on and yet allow the screw to turn while the protector stands still.

A holder for the puller is made, as in Fig. 8, of ½- or ⅝-in. steel plate. It is used to prevent the puller from turning when running down the screw under a heavy load. The holder is made by laying the finished nut on the steel plate and marking around the outside with a piece of crayon, after which the plate is cut out along the lines with a torch. Finally, the outside is cut as indicated—a piece of pipe can be slipped over the end, if desired.

## Hangers Utilized to Install Guard Boards

Neatness and strength are features of the system of hanging guard boards shown in the accompanying illustration, writes Walter Iman, Kitzmiller, Md. To support the guard boards two pieces of 1x4x9-in. oak are clamped around the hanger by ½x7-in. carriage bolts. Guard boards are



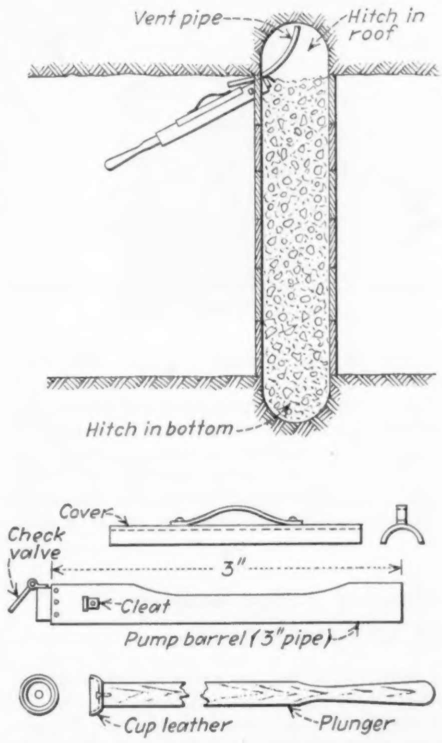

**Details of guard-board hanger**

then nailed or bolted to the clamp boards, which should not come down to the wire level, as otherwise clearance would be insufficient to permit passage of the trolley wheel and harp. By fastening the guard boards outside the clamp boards, however, sufficient clearance is obtained.

## Hand Pump Facilitates Completing Seals

The final step in the construction of concrete dams or seals—filling the hitch in the roof—has been greatly facilitated by the use of the hand pump shown in the accompanying illustrations, writes Anthony Shacikoski, mine foreman, Cochran Coal Co., Salina, Pa. In dams built under his direction, hitches are made in the coal on either side and also in the top and bottom. The thickness of the dams varies in accordance with the duty expected.

In constructing a dam the conventional forms are installed and the concrete is placed up to the roof level in the usual manner. This leaves the hitch in the roof to be filled, and here, if leaks are to be prevented, special equipment is needed to place the concrete so that the entire cavity will be filled to the top of the hitch. To facilitate placing the concrete in the hitch,




**Pump and vent pipe in position for filling the top hitch are shown above; below are the principal parts of the pump**

one or more curved vent pipes are brought out through the top of the form to let the air escape. These vent pipes are run up to the highest points in the hitches.

To fill the top hitch the hand pump is fastened to the form by cleats so that the discharge end will protrude into the space to receive the concrete. Firm attachment to the form is necessary to keep the pressure from pushing it out. Using a mixture of fine aggregate and cement made thin enough to run easily, which is placed in the pump by hand after each stroke, the hitch then is filled until the mixture begins to run out the vent pipe or pipes. This signifies that the filling has been completed.

Once started, filling of the hitch must be done continuously and quickly to prevent undue setting of the mixture with attendant difficulties in operating the pump. In the case the dam is large, two or more pumps may be necessary to insure having it filled before setting prevents further work. When the hitch is filled, the concrete is allowed to set for a few hours, after which the pump can be removed and the cavity filled with cement. Where the rock is creviced, it may be necessary to drive the pump plunger with a sledge to force concrete into the openings, in which case the vent pipes are plugged.

The barrel of the hand pump is made of a piece of 3-in. pipe about 3 ft. long. A flap-type check valve is fastened to the end which goes into the form to prevent the concrete from running back, and an oval hole is cut in one side of the pipe to receive the concrete mixture. Cleats are mounted on the barrel to hold the pump to the form. When the concrete is placed in the barrel, the oval hole is closed with a cover which is held in place by the man operating the plunger. The latter is made of a piece of trolley pole to one end of which a leather cup is fastened, using a wood screw and a 2¾-in.-diameter washer.

## Armature Slot Trough Bender Improves Shop Practice

Folding a set of troughs in 15 instead of 60 minutes and doing a better job than by the slow hand method are the advantages of a paper trough bender which finds frequent use in the central electric repair shop of the Sahara Coal Co., Harrisburg, Ill.

Fig. 1 shows the bender clamped in a vise ready for use. Lying on top of its roller is a paper trough that has been bent to the shape required as slot insulation for an armature. The part of the bender which is clamped between the jaws of the vise is a block of 1x4-in. steel 14 in. long. Fastened to this by three bolts is a

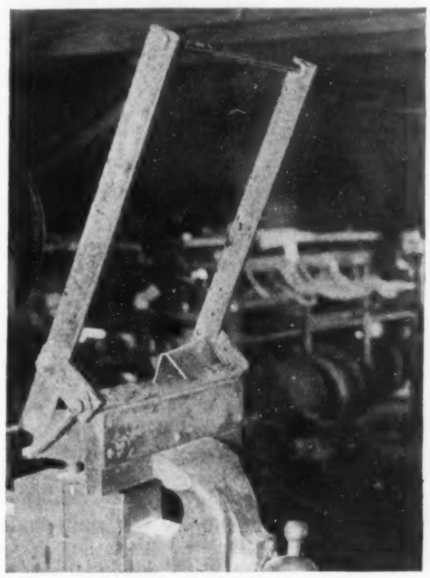


**Fig. 1—Clamped in the vise ready for use**

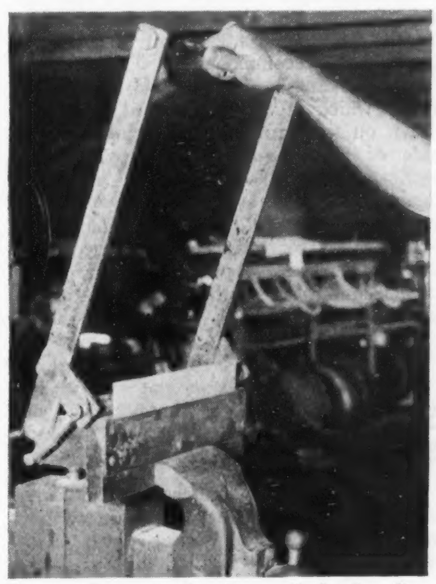


**Fig. 2—Paper in the slot ready for bending**

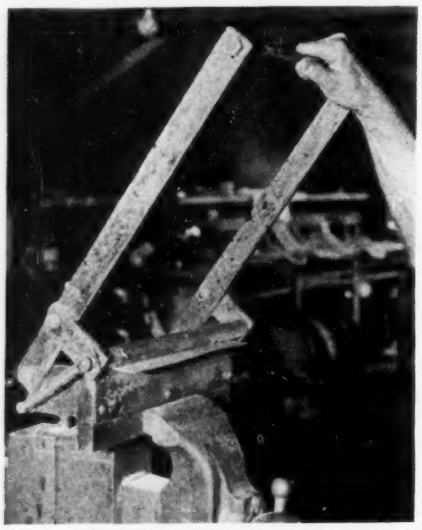


**Fig. 3—One right-angle bend already in the paper**

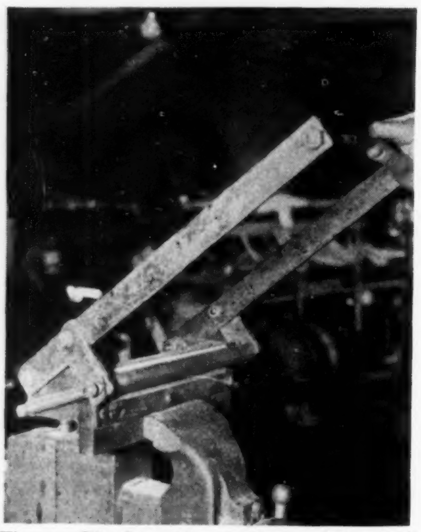


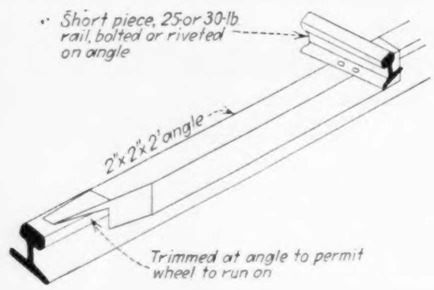
**Fig. 4—Final position and two right-angle bends in the paper**

¼x2½-in. faceplate of the same length but spaced from the block to form a slot of width slightly greater than the thickest paper to be accommodated.

The bending is done by a 1-in.-diameter roller which is forced forward by pulling down on the handle. Coil springs at each side of the frame hold the roller down against the top of the block and later against the side of the faceplate as the handle forces the roller over the paper and around the front edge. Figs. 2, 3 and 4 show the successive positions of the paper, handle and roller as the bending is accomplished.

## Sliding Shoe Stops Cars Before Striking Derail

A runaway car preferably should be brought to a stop, where possible, without wrecking it, writes Walter Iman, Kitzmiller, Md., in suggesting that a sliding shoe, such as shown in the accompanying




**Sliding shoe stops cars without wrecking them**

sketch, be placed inside a derail. The shoe consists of an angle beveled off to allow the car wheel to run up on it and fitted with a short piece of rail which acts as a stop. On a dry rail one wheel on the shoe will stop a car in a very short distance, says Mr. Iman, but if the shoe should fail the derail still is available to bring the car to a halt.

## Cooling a Hot Bearing In an Emergency

When a bearing is running hot and it is imperative that the machine be kept in operation a quick method of heat dissipation must be found. Lubricating alone, says John E. Hyler, Peoria, Ill., seldom will cool down an overheated running bearing, although the application of graphite with the oil will be a help and lubrication is a factor that must not be overlooked. After lubricating thoroughly, small wooden plugs may be placed in the oil holes and a stream of cold water turned on the bearing for a time. Then the plugs can be removed, more graphite and oil fed to the bearing and the cooling-water cycle repeated.

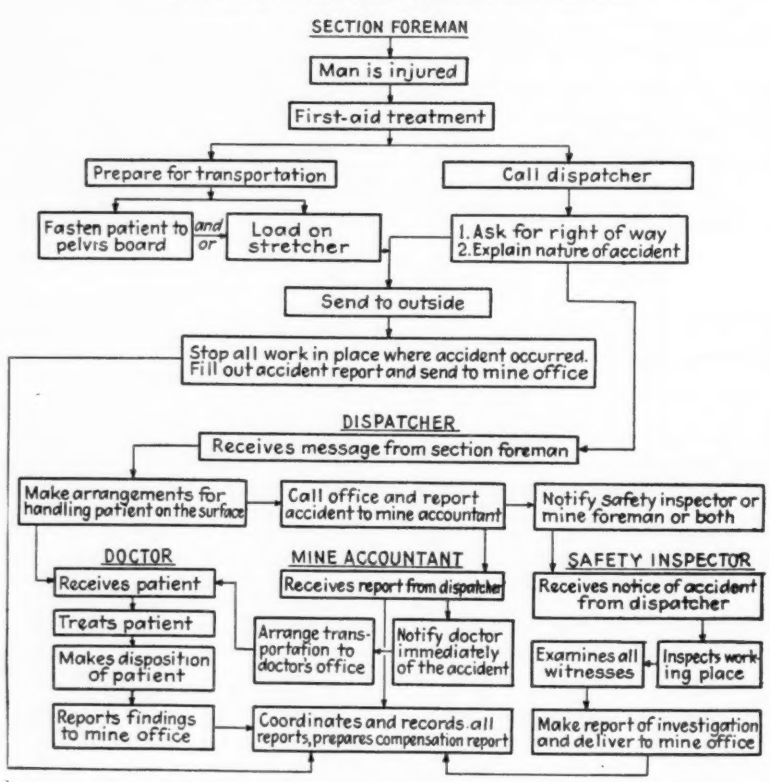
Another scheme which may be helpful in a great many cases is winding a helical spring around the bearing if it is open enough in design to permit such treatment. The spring will in a measure act as fins and provide more surface for the radiation of bearing heat.

## Standard Procedure Saves Time In Handling Injuries

To eliminate confusion and fix responsibility for the performance of certain duties when an injury occurs, the management of the Wharton (W. Va.) mine of the Koppers Coal Co. has prepared and is using an outline of a standard procedure for handling mine injuries, writes D. D. Jenkins, engineer, Montgomery, W. Va. The outline shows simply and forcefully every step to be taken in handling the injured man and later in investigating and reporting on the injury. The duties of each man are given in detail and in the order that experience has shown to be necessary.

Copies of the outline are furnished all section foremen and other copies are posted in the dispatcher's office, the mine office and the general plant offices. "Use of this standard method of procedure has expedited the handling of injured men and has eliminated delays and misunderstandings in the investigation of accidents."

**PROCEDURE IN CASE OF A MINE ACCIDENT**




**Saves time and eliminates misunderstandings in handling, investigating and reporting on injuries**

# WORD FROM THE FIELD

## Anthracite Week Emphasizes Coordinated Effort

Not only colliery operators, distributors and mine workers but organizations of business men of other industries in the hard-coal field of Pennsylvania joined forces in the second annual observance of "anthracite week," Oct. 5-10. Led by Anthracite Industries, Inc., organized to direct a mass appeal to consumers in anthracite-burning markets (*Coal Age*, August, 1936, p. 345), the celebration included exhibits in various market areas, efforts for better organization of wholesale and retail outlets, securing cooperation of manufacturers of every device pertaining to the industry and the inception of a market-wide promotion campaign on a scale never before initiated.

Emphasis was given to the part the public can play in cooperative effort by learning to burn sizes not previously in local demand as well as in helping to stamp out the bootleg mining evil. High hopes are based on the building era believed to be at hand, the exhibits of coal-burning equipment embodying up-to-date features in convenience, labor saving and moderate cost holding out special promise in the campaign to rehabilitate the anthracite industry.

## Safety Meets Well Attended

The eighth annual State Safety Day first-aid contest, held Oct. 17 at West Virginia University, Morgantown, in which teams from all over the State, chosen by elimination at various district contests, was won by the Powellton team of the Koppers Coal Co., but not until after an extra problem was worked in order to break a tie with the Carolina team of the Consolidation Coal Co. Before the extra problem was worked out, each beam had a score of 1,967 points out of a possible 2,000.

Another Koppers team—that from Grant Town—won first place in the negro group over the American Eagle Colliery team from Ameagle. Grant Town had 1,436 points and Ameagle 1,435 points, out of a possible 1,500.

A large attendance watched twenty teams go through their paces at the Western Kentucky first-aid meet, held Oct. 10 at Earlington. Teams in the white group finished in the following order: West Kentucky Coal Co., No. 2 mine; Dawson Daylight Coal Co., No. 6 mine; Black Diamond Coal Co.; West Kentucky Coal Co., Kentucky Block mine. Teams from No. 2 mine of the West Kentucky Coal Co. finished first and second in the colored division, followed by the group from North Diamond mine of the same company.

The Koppers Coal Co. team from No. 5 mine took first place among white teams in the Kanawha Valley Mining Institute

meet, held at Montgomery, W. Va. The winners received a silver plaque awarded by the National Coal Association. Other teams in the white division finished in the following order: Cannelton Coal & Coke Co.; Kellys Creek Colliery Co.; Cabin Creek Consolidated Coal Co., United mine; Cabin Creek company, Rose mine. Colored teams from Elk Ridge, Beards Fork and Kimberly mines of the Koppers Coal Co. finished first, second and third, respectively, in their division.

## Keeping Step with Coal Demand

### Bituminous Production

| Week Ended | 1936 (1,000 Tons) | 1935* (1,000 Tons) |
|---|---|---|
| Sept. 5 | 8,214 | 6,948 |
| Sept. 12 | 7,815 | 8,388 |
| Sept. 19 | 8,513 | 7,726 |
| Sept. 26 | 8,742 | 1,695 |
| Oct. 3 | 9,135 | 7,028 |
| Oct. 10 | 9,475 | 8,413 |
| Total to Oct. 10 | 315,775 | 276,305† |
| **Month of August** | 33,240 | 26,164 |
| **Month of September** | 36,772 | 25,038 |

### Anthracite Production

| | | |
|---|---|---|
| Sept. 5 | 728 | 531 |
| Sept. 12 | 718 | 794 |
| Sept. 19 | 838 | 1,000 |
| Sept. 26 | 979 | 1,573 |
| Oct. 3 | 1,267 | 1,049 |
| Oct. 10 | 1,035 | 1,213 |
| Total to October 10 | 39,465 | 40,786 |
| **Month of August** | 3,223 | 2,591 |
| **Month of September** | 3,818 | 4,172 |

* Outputs in these columns are for the weeks corresponding to those in 1936, although these weeks do not necessarily end on the same dates.

† Adjusted to make comparable number of working days in the two years.

### Bituminous Coal Stocks

(Thousands of Net Tons)

| | Sept. 1 1936 | Aug. 1 1936 | Sept. 1 1935 |
|---|---|---|---|
| Electric power utilities | 5,744 | 5,473 | 6,632 |
| Byproduct ovens | 5,982 | 5,302 | 6,950 |
| Steel and rolling mills | 947 | 916 | 1,283 |
| Railroads (Class 1) | 4,303 | 4,254 | 7,561 |
| Other industrials * | 8,194 | 7,781 | 10,125 |
| Total | 25,170 | 23,726 | 32,551 |

### Bituminous Coal Consumption

(Thousands of Net Tons)

| | August, 1936 | July, 1936 | August 1935 |
|---|---|---|---|
| Electric power utilities | 3,662 | 3,597 | 2,911 |
| Byproduct ovens | 5,548 | 5,332 | 3,996 |
| Steel and rolling mills | 1,038 | 1,010 | 901 |
| Railroads (Class 1) | 6,535 | 6,500 | 5,766 |
| Other industrials * | 8,634 | 8,543 | 6,725 |
| Total | 25,417 | 24,982 | 20,539 |

* Includes beehive ovens, coal-gas retorts and cement mills.

## Railroads Ask Rate Increase In Lieu of Surcharges

The Interstate Commerce Commission granted on Oct. 23 a request by the railroads of the country, made on the preceding day, for a temporary suspension of past rate decisions, thus paving the way for consideration of numerous rate changes proposed by the carriers. The Commission docketed the petition as Ex Parte No. 118 and set Nov. 7 as the date by which all replies to the rate adjustment proposal must be filed. No opportunity will be given for oral argument.

The rail carriers, having as their spokesman D. T. Lawrence, chairman of the traffic executives committee, announced on Oct. 1 at a meeting in Washington, D. C., a plan to increase freight rates so as to obtain revenue to take the place of the so-called emergency charges which are to expire on Dec. 31 next.

According to Secretary Battle, of the National Coal Association, the proposed increases will in the aggregate amount to a greater burden on bituminous coal than the present surcharges. He informed the railroads' representatives at the meeting that the bituminous industry is unalterably opposed to the proposals affecting coal and coke.

The text of the proposal relating to coal and coke (not including ground or pulverized coal or coal dust or ground or pulverized coke or coke dust in packages) provides:

Scale No. 1—Where the rate per ton is 0 to 75c. the increase is to be 3c. per net or gross ton; 76c. to $1, 5c. per net ton and 6c. per gross ton; over $1, 10c. per net ton and 11c. per gross ton.

There are these qualifications:

1. Except as indicated below, rates within and to the West to be increased on the following scale:

Scale No. 2—Where the rate per ton is 0 to 75c. the increase is to be 3c. per net ton; 76c. to $1, 5c.; $1.01 to $2, 10c.; over $2, 15c.

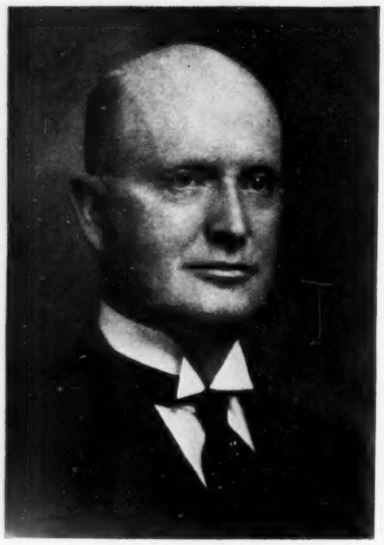
Exceptions—(a) Will not apply in the instance of rates on coal to Milwaukee, Racine, Kenosha, Wis.; Waukegan, North Chicago, Ill., and intermediate points to which Scale No. 1 will apply. (b) Where rates from Illinois, Indiana and western Kentucky are not increased by the maximum under the Western scale—i.e., 15c. per net ton—rates from Eastern and Southern origin groups will be increased 10c. per ton. (c) Rates from Utah and Wyoming to the Pacific Northwest are not to be increased.

2. Rates established to meet truck and/or water competition and so indicated in the tariffs, where emergency charges are not now applied, need not be increased.

3. Rates on unprepared anthracite coal moving to breakers for preparation and reshipment by rail will not be increased.

4. Ex-river coal rates from Conway, Colona, etc., except those covered by No. 2 above, to be increased in the same amounts in cents per ton as the all-rail rates from the Pittsburgh district to the same destinations are increased.

5. Rates on coal from Lake Superior



**Erskine Ramsay**

and Lake Michigan docks to the interior to be increased as per Scale No. 1.

Rates on lake cargo coal moving to the Eastern ports of transshipment to be increased 10c. per net ton. Efforts are to be made to effect some arrangement, with the consent of the Interstate Commerce Commission, under which on lake cargo coal having a revenue road haul by rail beyond docks at Lake Michigan and Lake Superior ports, a single increase of 15c. per ton shall be applied to the combined revenue of the rail lines both to the Eastern ports and from the Western ports.

Rates on tidewater coal moving to the Eastern ports of transshipment to be increased 11c. per gross ton. Efforts are to be made to effect some arrangement, with the consent of the Interstate Commerce Commission, under which tidewater coal moved by rail from docks at the New England ports to destinations in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont will be subjected to a single increase of 11c. per gross ton.

## Illinois Institute Meets

Illinois Mining Institute—one of the veteran organizations of the industry—held its 44th annual meeting at the Hotel Abraham Lincoln, Springfield, Ill., Oct. 23. Safety and new developments in improving undercutting-machine bits dominated the technical side of the sessions, with T. J. Thomas, president of the institute and of the Valier Coal Co., opening the safety discussion and John Parker, superintendent, Inland Steel Co., Kentucky, leading off on machine bits. Marc Bluth, executive secretary, Committee of Ten—Coal and Heating Industries, started the economic side with a paper on the industry's new opportunities. Future relations of the bituminous coal industry and the government were the subject of an address at the annual dinner by Charles F. Hosford, Jr., chairman, National Bituminous Coal Commission.

The meeting took place just as this number of *Coal Age* was going to press. A detailed report of the Springfield deliberations will be published in December.

## *Coming Meetings*

• Indiana Coal Operators' Association; annual meeting, Nov. 17, Terre Haute, Ind.

• Coal Mining Institute of America: annual meeting, Dec. 10 and 11, Fort Pitt Hotel, Pittsburgh, Pa.

## Ramsay Given Saunders Medal For Mining Achievement

Erskine Ramsay, chairman of the board, Alabama By-Products Corporation, has been awarded the W. L. Saunders gold medal for 1937, given annually for "distinguished achievement in mining." The award was made by the unanimous vote of the board of directors of the American Institute of Mining and Metallurgical Engineers at a meeting in New York on Oct. 15. Previous recipients of the Saunders award include Herbert Hoover, the late John Hays Hammond, D. C. Jackling, W. H. Aldridge, Pope Yeatman, James McNaughton and Clinton H. Crane. The action by the A.I.M.E. board was taken in recognition of the many contributions made by Mr. Ramsay to the art of mining bituminous coal both through the invention and practical application of machines and equipment and through the development of efficient methods of operation.

The new medalist was born in Pennsylvania Sept. 24, 1864, and spent the early years of his life in the Connellsville coke region, where he was associated with the Frick interests. He resigned as assistant engineer of the Frick company in 1887 to accept the position of mining engineer of the Pratt division of the Tennessee Coal, Iron & Railroad Co. and has had an increasingly prominent part in the industrial and civic life of Alabama ever since. The story of his early days and of his experiences with the Tennessee company was told in the October issue of *Coal Age* (p. 469).

★ ★

### SALES OF MECHANICAL STOKERS SHOW STEADY GAIN

SALES of mechanical stokers in August last totaled 9,557, of which 8,433 were small residential-size units, according to statistics furnished the U. S. Bureau of the Census by 108 manufacturers. This compares with sales of 6,288 units in the preceding month and 5,712 in August, 1935. Figures for the first eight months of this year show that 35,608 units of all types and sizes were sold, compared with 19,302 in the corresponding period a year ago. Sales by classes in the first eight months of this year were as follows: residential (under 100 lb. of coal per hour), 31,377; apartment-house and small commercial heating jobs (100 to 200 lb. per hour), 1,744; general heating and small high-pressure steam plants (200 to 300 lb. per hour), 721; large commercial and high-pressure steam plants (over 300 lb. per hour), 1,766.

**Walter M. Dake**

## Dake Joins Coal Age Staff

Walter M. Dake, for a number of years consulting engineer in charge of sales, Joy Manufacturing Co., has resigned from the Joy staff to join the mining publications group of the McGraw-Hill Publishing Co. as manager of research activities for the editorial and business departments of *Coal Age* and *Engineering and Mining Journal.* Mr. Dake's early engineering experience, which began in 1903, was in the metal-mining and public utility fields in California, Colorado, Nevada, Utah and Mexico. His active coal career started in 1918, when he became confidential engineer for L. F. Rains; later he was associated with the Blazon Coal Co., Wyoming; Carbon Fuel Co., Utah; Morton Coal Co., Utah; and the Rock Springs Coal & Mining Co., Wyoming. He organized his own consulting engineering service in 1921 and in 1922 joined the engineering division of the United States Coal Commission as administrative assistant. In 1924 he became associated with the Joy Manufacturing Co. and continued with that organization until the end of last month.

Mr. Dake is a member of a number of engineering societies including the A.I.M.E., American Mining Congress, Rocky Mountain Coal Mining Institute, Illinois Mining Institute, Coal Mining Institute of America and the Engineers' Society of Western Pennsylvania.

## *Personal Notes*

C. A. CABELL, president, Carbon Fuel Co., and D. C. KENNEDY were reelected president and executive secretary, respectively, at the 32d annual meeting of the Kanawha Coal Operators' Association. Mr. Cabell has headed the organization for several years and Mr. Kennedy has held his post since the association's inception.

JOHN F. DANIEL has been reappointed chief of the Division of Mines and Minerals of Kentucky, effective Oct. 1, according to an announcement by Governor Albert B. Chandler.

ERIC GEORGE has been appointed super-

intendent of the Glen White mine of the Koppers Coal & Transportation Co., in Raleigh County, West Virginia.

HARRY E. MORAN, president of the Leconey Smokeless Coal Co., operating in Clay County, West Virginia, has been elected president of the C. H. Mead Coal Co., Beckley, W. Va., in which he and his associates purchased a controlling interest late in September. CLAUDE JARRETT, vice-president and general manager of the Leconey company, has been named to serve in a similar capacity with the Mead company.

T. J. O'BRIEN, president, Kemmerer Coal Co., and sales manager, Gunn-Quealy Coal Co., has been elected president of the Southern Wyoming Coal Operators' Association. L. W. MITCHELL has been renamed executive secretary.

WILLIAM REDSHAW, superintendent of the Megeath Coal Co. at Rock Springs, Wyo., for the last eleven years, has been given charge of operations of the Roundup Coal Mining Co., Roundup, Mont., as well as of the Sheridan Coal Co., Hudson, Wyo.

T. J. ROBERTSON has been appointed foreman of No. 3 mine of the Raleigh-Wyoming Mining Co., Raleigh County, West Virginia.

JOHN SPIKER has been made superintendent of Byrne No. 1 mine of the New Byrne Coal Co., Fairmont, W. Va.

W. A. VINSON, of Madisonville, Ky., who has been a district mine inspector for several years, has resigned to join the Hart Coal Corporation, Mortons Gap, Ky., as assistant superintendent. HARRY N. SMITH, of Corbin, Ky., succeeds him as district mine inspector.

## New Preparation Facilities

CORNETT-LEWIS COAL CO., Louellen, Ky.: contract awarded Jeffrey Mfg. Co. for washing-plant addition to present tipple, equipment to include two-compartment Jeffrey automatic Baum jig with complete facilities for dewatering and classifying the washed coal, also settling tank, Jeffrey skimming flumes and sludge conveyors; jig and settling tank to be at ground level resting on concrete foundations and the classified washed coal carried to loading points by multi-compartment conveyor; capacity, 140 tons per hour of washed coal, loaded on five tracks or combined with raw coal, as required.

GAY COAL & COKE CO., Gay, W. Va.: contract awarded Wilmot Engineering Co. for Wilmot Simplex Type D stove jig; capacity, 40 tons per hour (addition to existing equipment).

KINGSTON-POCAHONTAS COAL CO., Exeter mine, Hemphill, W. Va.: contract awarded Jeffrey Mfg. Co. for three-compartment Jeffrey Baum automatic jig to handle 175 tons of 4x½-in. coal per hour; also dewatering screen in two balanced sections to dewater 160 tons of 4x½-in. coal per hour.

KOPPERS COAL CO., Wharton, W. Va.: contract awarded McNally-Pittsburg Mfg. Corporation for Parrish type screening equipment to handle 450 tons per hour of mine-run and separate into three sizes; completed Oct. 15.

# Swing to Mechanization in West Virginia Reflected by Institute Papers

THAT mechanical loading and conveyor transportation singly and in combination have taken deep root in the last six months in West Virginia, especially in Logan County, and that the mine operators have approached the evolution with full cognizance of the changes likely to be necessary in supervision, transportation and preparation was evident at the annual meeting of the West Virginia Coal Mining Institute held at Logan Sept. 25-26. Safety, treated timber, air-sand cleaning and interconnected power systems also were discussed. E. B. Agee, mine superintendent, Youngstown Mines Corporation, and retiring president of the institute, presided at the Logan sessions.

Tracing the history of American coal mining and its parallel industrial revolution, Howard N. Eavenson, consulting engineer, Pittsburgh, struck an optimistic note for the future of coal and declared that, contrary to some opinions, the benefits of research have outweighed the effects of the higher utilization efficiencies brought about by research.

**N. P. Rhinehart**
President-Elect, West Virginia Coal Mining Institute

Selection of a loading machine for a particular mine is a matter of weighing the advantages and disadvantages of one type against another, asserted W. H. Roberts, engineer in charge of mechanical loading, Island Creek Coal Co., in a paper dealing with general factors pertaining to mechanical coal loading. First among the considerations is that the coal customer be satisfied and next come the factors of the coal seam itself; i.e., height; whether the coal is soft, friable, blocky, flinty; impurities in the seam and location; bottom characteristics; roof conditions; and grades. Labor is a consideration in selecting the machine because different degrees of skill are required to operate the various types. To a certain extent mine layout can be suited to the machine except that costs may impose some limitations.

Speaking of the auxiliary changes usually necessary with the introduction of mechanical loading, Mr. Roberts listed maintenance, electric-power supply, track (a type classed as "good" with hand loading is inadequate), room-switch location (car-changing switch should be less than 100 ft. from the face), and supervision as the items of common necessity to all conditions. He spoke of the safety of mechanical loading as "probably the most gratifying angle," and declared that mechanization has lowered the accidents per ton in practically all cases and has lowered the accidents per man-hour in "most" cases.

"You must not get discouraged," the admonition of H. S. Gay, vice-president of the Gay Coal & Coke Co., was significant because in his discussion of Mr. Roberts' paper it followed an outline of mechanical loading started in 1913 at the Gay mines and today accounting for the entire daily production of 1,700 tons (700 tons from a 4-ft. seam and 1,000 tons from a 5½-ft. seam). Five or six different machines were tried originally at the mine and the first machine, on which $17,000 was spent, had to be junked.

### Just One Machine May Raise Cost

Just one loading machine in a mine possibly may increase the mining cost; therefore the management must be prepared to install more machines to gain the real advantage, asserted Mr. Gay. The foreman must be of an active type who is determined to make the loading machines perform to best advantage. Means must be provided to discover irregularities quickly in any of the work leading up to and affecting machine production and the men should be trained to realize that there will be no delay in discovery.

Larger lump but more slack has been the result of mechanical loading in the Gay mines, which are situated close to Logan, and it is contemplated that mechanical cleaning must be added to the preparation of certain sizes. Power standards of the company call for a d.c. voltage of 240 or more at the working face at all times. Mr. Gay warned that organizing mechanical loading in a low seam is much more difficult than in a high seam. As to the safety experience, over 1,500,000 tons has been mined in the company's Island Creek seam without a fatality.

Layout and the condition of track are of first importance, stated Charles W. Connor, general superintendent, Nellis Coal Corporation, which recently installed mobile loaders in the 53- to 54-in. seam at the Nellis mine in Boone County. Nellis changed from 20-lb. to 30-lb. rail in rooms and installed switches at breakthroughs to reduce the car-change distance to 100 ft. Use of two locomotives instead of one to serve a loader materially raised the efficiency. The car-change time with one locomotive was 60 to 90 seconds, but with two it was reduced to as little as 15 seconds. The seam contains a parting and it has been determined that one type of loader has advantages over the other in cleaning at the face. Thirteen men compose a room mining

crew with one type of machine and fourteen with the other. Seven men make up a crew using a machine for loading coal and slate in development work.

Outlining the mechanization started six months ago by the West Virginia Coal & Coke Corporation at its Stirrat No. 19 mine in Logan County, J. C. Lowry, assistant manager of mines, said there was reason to believe the work would be in 46- to 54-in. clean coal with favorable top, but instead the company encountered bad top, some dirt in the seam and places as thin as 40 in. Equipment consists of Joy 12BU machines loading onto chain-flight conveyors and these in turn discharging onto a belt conveyor. In the development work, which was carried on without difficulty, the production was 180 tons per shift. When rooms were turned, certain difficulties were encountered, but during the best week 270 tons was produced per shift. At present the section is operated two shifts, but three shifts and 300 tons per shift is the goal. Use of a large hoist with pushbutton control to move the trip at the loading point has made practicable the employment of but one man for the moving and trimming duty. Three tons is the average car loading.

Revamping the transportation system, declared Mr. Connor, in a paper dealing with trends and practices in transportation for mechanical mining, is but another example of stark necessity bringing about improvement. Mechanical loading feeds the coal more rapidly and the transportation must be put in tune. Among the considerations of personnel, safety, equipment, power, signaling, dispatching and illumination, the second was given special emphasis; "in mechanical mining the transportation men are key men and should be selected with care."

In order to reduce the time required for car changes the trend, continued Mr. Connor, is to use gathering locomotives of higher speed and greater weight. In contrast with the early gathering locomotives of 4 to 5 tons for serving hand loading, units of 8 to 10 tons weight are now being used to serve loading machines. For room tracks, 30-lb. rail is coming into common use and welded joints are a recent development for main lines. Adequate power by reason of closer voltage regulation assumes greater importance.

### Transportation Vital to Output

"Transportation is the backbone without which production cannot be attained," asserted R. E. Salvati, general manager, Island Creek Coal Co. Placing switches in breakthroughs to allow cutting during the loading shift effects a concentration which in turn increases the efficiency of supervision. In the Pocahontas mines in 48-in. coal this has made it possible to mine two cuts per shift and secure 16 to 18 tons per man.

Lantern slides of treated timber applications in mines of the Consolidation, Hudson, Hanna and Bell & Zoller companies were used by A. Reamy Joyce, district manager, Wood Preserving Corporation, Marietta, Ohio, as illustrations for a paper dealing with pressure-treated ties and timbers in coal mines. Wood treatment began in England one hundred years ago, was patented there in 1838, and in 1877 the Louisville & Nashville R.R. constructed the first creosoting plant in the United States. Treated timbers installed in an anthracite mine in 1906 are still in service. Treatment is simply a poisoning of the wood to prevent the growth of fungi. To make room for the chemical, the surplus water in green timber must be removed, and this is best done by outside storage in properly drained locations.

**After Nine Years' Service**

Creosoted mine ties installed in 1926 in the main heading of mine No. 32 of the Consolidation Coal Co. were in excellent condition, as shown in the above picture, taken in 1935.

Modern treating plants now have woodworking mills where timbers and framing can be cut to exact dimensions before treatment. Mr. Joyce projected on the screen the picture of a treating plant which he said represented a million dollar investment, half of that being in plant equipment and the other half in inventory. He declared that the Baltimore & Ohio, New York Central and Pennsylvania railroads are saving $200 per mile per year by the use of treated ties. Tie renewals per mile per year averaged 65 from 1930 to 1935, in contrast to 243 in the period of 1907 to 1911, before treated ties were adopted.

Obtaining only 4 to 5 years' life from untreated white oak ties recently caused the Pond Creek Pocahontas Co. to turn extensively to treated timber, said F. C. Carothers, general superintendent. Conditions at the company properties are dry mines, heavy cover and high-velocity air. Since Jan. 1, the original ties of three miles of 60-lb. track have been replaced with 5x7-in. zinc-chloride-treated ties. Now treated ties and timber have been adopted as the standard for main lines in all of the mines. Untreated pony sets and cribbing on top of main sets began to fail in three years, so treated wood has been adopted also for that work. When tracks are to be removed from airways that are to be used for five years or more, two rows of treated posts are installed. Creosote-oil treatment is being applied to underpinning and steps of houses. Chestnut poles of the original lines serving the town lighting are being replaced with treated pine or butt-treated Western cedar.

Maintenance of two miles of 60-lb. main-line track built with 5x7-in. x 6-ft. treated ties and rock ballast in the Consolidation Coal Co.'s No. 32 mine, Owings, W. Va., has cost almost nothing and has not exceeded $25 in any one year, said F. F. Jorgensen, general manager of production. The construction with treated ties was started in 1926 and when rock ballasting was completed the derailments stopped and the round-trip time on the track was cut 19 minutes. These ties, which were given an 8-lb. treatment, are in excellent condition today and tests indicate they will last another ten years. More than 5,000,000 tons of coal hauled by several 13-ton locomotives and one 20-ton locomotive have passed over this track. Mine cars used weigh 2 tons empty and their average capacity is 4 tons of coal; a standard trip is 40 cars.

Tests in the Consolidation mines indicated that car bottoms of wood deteriorate more from decay than wear, so treated wood has been adopted for all replacements. At first, complete drilling before treatment was tried, but many of the bolt holes would not line up; so only fifteen to twenty of the main holes are now drilled before treatment. The remainder are drilled during installation but are gun-treated with creosote before the bolt is installed. Cars with treated bottoms are in good condition after six years' service, while untreated bottoms are in bad condition after four to five years' service.

First costs of treated timber for mine use are much higher, of course, than for untreated, but Mr. Jorgensen asserted that "in the end cost there is no comparison because the labor cost of replacement is so large." The safety and certainty of protection is a valuable item. He believes that where excessive moisture is present the salt treatment is not as good as the creosote.

The subject of safety was introduced in the meeting by a paper prepared by Edgar H. Graff, safety director, New River Co., read by A. S. Wilson, general manager, Boone County Coal Corporation. Effective progress demands that safety be sold to the entire organization, was the observation of Mr. Graff. "First we must sell ourselves the idea that accidents can be controlled and realize that accidents are an obvious failure to control ourselves—which is a disgrace." Teaching safety to the children in the schools is the most effective place to start.

That West Virginia seems to be slipping back to a series of major accidents and explosions was brought out by N. P. Rhinehart, chief, State Department of Mines. More overcasts are needed and

something must be done to keep closed the doors that are in service. The rapidity of new developments in mining methods in Logan County in the last six months has introduced many new problems in safety, declared Adam Crawford, safety director, Mallory Coal Co. It is necessary to devise new methods of doing work, accommodate methods to two- and three-shift operation and learn the proper procedure in handling heavy equipment in low beds. Better supervision, improved illumination, and a higher standard of foremanship are the natural demands of mechanization and should work to the advantage of safety. Mr. Crawford stated that certain authorities believe there has been a letdown in discipline and asserted there must be discipline, not of fear but of confidence, which tends to teach and help.

Discussing the increase of accidents in Logan County, Mr. Gay said the fault is more with the mine management than with the foreman. The latter needs better instruction and backing from the management. It is no small task to adjust the union labor to mechanization and the foreman must have the strength necessary to keep up the continuous grind of keeping in touch with every detail.

Attacking the problem of safety by obtaining the cooperation of the workmen was advised by Mr. Connor. When safety rules were to be formulated for the Nellis mine, the men were called upon for suggestions and the rules were adopted with their consent. "Workmen appreciate having a part in what is going on," was his observation.

In a paper, "Some Observations of the Continued Use of Obsolete Methods," R. Laird Auchmuty, engineer with Eavenson & Alford, found excuse for but few of the outmoded methods practiced by many mines that cannot be classed as small and insignificant. Complicated wage scales in the anthracite region account for some of the obsolete methods and certain mining laws account for a few in the bituminous. Among the several incongruous methods he has observed, the use of the carbide lamp is one for which he found the least excuse.

#### Old Methods Persist

That old methods in vogue before the turn of the century are still in common use was indicated by the following information which he secured from the 1934 *Minerals Yearbook:* Sixteen per cent of the total underground bituminous output was mined by solid shooting and hand methods, while only 12.2 per cent of the output of underground mines was loaded by machines. In the anthracite field, 19 per cent of the 1934 underground output was loaded mechanically, while only about 4 per cent was cut by machines. In Illinois, several shaft mines of one company were observed to be shooting all coal from the solid with black powder, hauling in cars of 1 to 1½ tons capacity and using some wood rail. Many central Pennsylvania mines shoot from the solid and some still use wood rails or one wood rail and one steel rail where a locomotive is to be supplied with current. In contrast with those cases, Ohio has wagon mines in which most of the coal is loaded mechanically.

"Factory methods," said Thomas A. Stroup, mining engineer, West Virginia Coal & Coke Corporation, Omar, "can never be worked in a mine because when you mine a ton of coal you must go to a new place to get it, and the conditions may be different." He pointed out that methods most economical for a mine that must run short time and depend on uncertain markets may class as obsolete for a mine with a large output and a steady market. But he cannot see any excuse for obsolete methods in safety.

Contrary to popular belief, said V. M. Marquis, engineer, American Gas & Electric Co., New York, in discussing interconnected power systems, the flow of power is only 60 to 70 miles because the interchange of power operates on the substituting, shifting or brigading principle. At some point, usually beyond that distance, it is cheaper to ship coal than to transmit electricity. Power generated by water also is limited to a certain radius of transmission. Among the chief advantages of interconnection are: (1) Plants can be located to better advantage with respect to water supply; (2) plants can be made larger and more efficient; (3) less reserve capacity is required; (4) allows use of the most efficient unit to suit the load for the time of day; (5) provides for staggering generating capacity; (6) makes possible an interchange of steam and water power; (7) allows a diversity interchange, and (8) provides for mutual help during emergency.

W. W. Beddow, manager of mines, Logan County Coal Corporation, described the new double-unit Stevens-Adamson air-sand cleaning plant put into use by the company in November, 1935, at Lundale, in Logan County (*Coal Age*, April, 1936, p. 139). Taking stock after almost a year of operation, Mr. Beddow said that the results have been highly satisfactory and the rejects amount to a bank loss of approximately 0.5 per cent. Only one change has been made in the equipment. That consisted of changing the sand drying blower to the opposite side of the hot-air furnace so as to put negative pressure in the furnace to reduce leakage and consequent heat loss.

The Lundale operation, explained Mr. Beddow, is a dry mine, but on wet days it is necessary to bypass as much as 100 tons of the 1¼x0 raw coal. Desanding screens operate satisfactorily and the sand is not diluted with coal dust because the Roto-clone exhauster-dust percipitator removes the coal dust together with the small amount of stone dust resulting from wear and degradation of the sand. Asked if the plant would work satisfactorily without recirculation of middlings, Mr. Beddow answered that that would depend upon the quantity of intermediate material in the coal. As to ash regularity in the finished product, he said that the Lundale plant turns out a coal of uniformly low ash.

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## *At Institute Helm*

**N. P. Rhinehart, chief, State Department of Mines, was elected president of the West Virginia Coal Mining Institute at the annual meeting held in Logan last month. Mr. Rhinehart, who was vice-president of the organization, succeeds E. B. Agee, mine superintendent, Youngstown Mines Corporation, Dehue.**

**Carel Robinson, general manager, Kellys Creek Colliery Co., Ward; F. F. Jorgensen, general manager of production, Consolidation Coal Co., Fairmont; and George Caldwell, general superintendent, West Virginia-Pittsburgh Coal Co., Wellsburg, were reelected vice-presidents, and Charles W. Connor, general superintendent, Nellis Coal Corporation, Nellis, and W. J. German, general superintendent, Pocahontas Fuel Co., Pocahontas, Va., were added to the vice-presidential roster.**

**The 1936-37 executive board includes: R. J. Burmeister, general manager, Raleigh Coal & Coke Co., Raleigh; R. E. Salvati, general manager, Island Creek Coal Co., Holden; E. H. Shriver, mine superintendent, Raleigh Coal & Coke Co., Raleigh; T. E. Johnson, vice-president, Hutchinson Coal Co., Fairmont, and Mr. Agee.**

**C. E. Lawall, head of the department of mining engineering, West Virginia University, Morgantown, continues as secretary-treasurer.**

## Inspect New Drainage Tunnel

The Pocahontas Fuel Co. was host to a group of coal and railroad men on Oct. 27 when the new 18.6-mile drainage tunnel system from Boissevain to the Pocahontas colliery No. 36 was thrown open for inspection. Work on driving this tunnel system—the longest ever built—was started in 1926 and was only recently completed. At present, the tunnel connections take care of five mines and drain an area containing 200,000,000 tons of coal.

## Opens Three New Mines

Three new mines have been opened by the Warner Collieries Co., one in Ohio and two in West Virginia. The new Ohio operation, Camel Run, is in Belmont County and produces coal from the No. 8 seam, output at the present time averaging 1,000 tons daily, though it is expected that it will be increased to 2,000 tons daily within a few months. The new West Virginia operations are at Harewood and Mammoth. The first named, known as Kanawha & Hocking Coal & Coke Co. No. 116 mine, is producing 2,000 tons of Eagle seam coal daily (*Coal Age*, June, 1936, pp. 226-228). The mine at Mammoth, as yet unnamed, is producing only 100 tons per day thus far, in the Coalburg seam. The company's Crabapple No. 1 and No. 2 mines, at Fairpoint, Belmont County, Ohio, are entirely worked out.

## Youngstown Mine Leased

The Youngstown mine of the H. C. Frick Coke Co., in Fayette County, Pennsylvania, has been leased to the Bortz Coal Co., Uniontown, Pa. After necessary repairs, the lessee purposes putting the plant into operation about Jan. 2, 1937.

# Smoke Abatement and Better Combustion Paired at ACI Engineers' Meeting

HOW the coal industry can promote smoke abatement by educating the consumer in better combustion technique was emphasized at the sixteenth meeting of fuel engineers sponsored by Appalachian Coals, Inc., and held at the Queen City Club, Cincinnati, Ohio, Oct. 5. "Smoke abatement and better combustion," declared J. E. Tobey, manager, ACI Fuel Engineering Division, "are synonymous. For that reason," he told the more than 100 combustion engineers, Smoke Prevention Association of America officials, railroad, coal-burning equipment and Bureau of Mines representatives present, "smoke abatement authorities and fuel engineers are partners and have a common job to do."

The coal man and the smoke abatement official, said W. E. E. Koepler, secretary, Pocahontas Operators' Association, and first vice-president, Smoke Prevention Association, are "both serving the public—at different ends of the stack, of course—and have a mutual responsibility for the service we both render. Smoke means waste. Cincinnati," he added, "is an excellent example of what can be done with the correction of atmospheric pollution by the abatement of smoke. You have little smoke from the industrial and other large users and less from the household sources, which are really the worst in all cities. With the public so rapidly taking to air conditioning, coal men must take the warning, which is also an opportunity, to attain the highest possible standards of combustion to retain and retrieve coal's important place in the power and comfort phases of modern life."

Collective cooperation of coal, general industry, the public, railroads and smoke-prevention groups is most important in waging a successful battle against the smoke evil, asserted William G. Christy, smoke abatement engineer, Hudson County, New Jersey. "Smoke abatement is the kind of a job that someone has to keep at continually. The elimination of smoke is a major community problem, comparable with maintaining streets and keeping the water supply pure. All too often when there is a cry for economy, the smoke department is one of the first to suffer. Several cities have made commendable records; then have felt the job was accomplished. Smoke bureaus have been discontinued or greatly curtailed; usually, within a few months, the results of several years' efforts are lost. Better combustion and smoke abatement are problems in mass education."

Sulphur was pictured as a destroyer by Frank A. Chambers, chief smoke inspector, Chicago, and secretary-treasurer, Smoke Prevention Association. The "grime, soot and dirt resulting from smoke can be removed from surfaces that are soiled," but damage caused by sulphur oxides is "irreparable. The public is waking up to the menace of sulphur in coal. Legislative and administrative action will soon follow an awakened public demand to curtail the effects of sulphurous compounds. In order to prevent ill-advised action on the part of civic authorities, it is to the best interests of the coal industry that it make a thorough study of the possible economic solutions of this problem."

Because, as pointed out by Frank H. Lamping, executive secretary, Smoke Abatement League of Cincinnati, who cooperated with Mr. Tobey in arranging the program, "advocates of smoke abatement are more or less tied in with the coal industry, coal operators should be vitally concerned with the atmospheric pollution of American cities." In Cincinnati, he said, the total soot fall averages 33.3 tons per square mile per month; during the winter, the quantity rises to 50 tons. "An average of three years in the metropolitan district shows 120 tons of pollution in each square mile per month. In Chicago, soot collections recorded 95.82 tons average per square mile per month during 1934-35; 68.57 tons in 1935-36."

Coal, however, is not wholly responsible for these tonnages. "There are other sources of pollution," said Mr. Lamping, "which should be considered and scrutinized, such as the automobile exhaust and contributions from nature. We do know, however, that as nature's contribution and dust storms diminish during the heating months, the tonnage per square mile per month in Cincinnati practically doubles. This problem of smoke abatement is one which coal operators must face in the future in their marketing programs. The American family has come to recognize that cleanliness is a virtue and will more and more strive to protect that virtue in the future." The Appalachian companies, he added, are "pioneering from the coal operators' standpoint in accepting smoke abatement as a discussion topic. Perhaps this is the beginning of a new era in smoke abatement."

Outlining the steps necessary to improve combustion practice, William Culbert, chief smoke inspector, Nashville, Tenn., urged that much of the engineering data and miscellaneous information on better combustion and smoke abatement should be "reduced to simple terms." Industrial consumers in Cincinnati, said Prof. Louis T. More, president of the Cincinnati Smoke Abatement League, are more or less under

**Coal Joins Hands With Smoke-Abatement Authorities**

Fuel Engineering Division, Appalachian Coals, Inc., stages conference to discuss better combustion methods as key to smoke abatement. Seated, left to right, W. E. E. Koepler, first vice-president, Smoke Prevention Association of America, and secretary, Pocahontas Operators' Association; R. E. Howe, vice-president, Appalachian Coals, Inc.; J. E. Tobey, manager, Fuel Enginering Division, ACI; Frank H. Lamping, executive secretary, Smoke Abatement League of Cincinnati; John D. Battle, executive secretary, National Coal Association. Standing left to right, Clifford Stegner, Commissioner of Buildings, Cincinnati; William Culbert, chief smoke inspector, Nashvlle, Tenn.; William G. Christy, smoke abatement engineer, Hudson County, New Jersey; Andrew W. Jones, smoke inspector, Atlanta, Ga.; Gordon D. Rowe, chief smoke inspector, Cincinnati; J. F. Barkley, supervising engineer, fuel economy service, U. S. Bureau of Mines; Frank A. Chambers, chief smoke inspector, Chicago, and secretary-treasurer, Smoke Prevention Association of America.

control. The big question is "how to solve the smoke problem in the homes of Greater Cincinnati." Consumer education was the answer, and the responsibility for that education was laid on the retail coal merchants, who, asserted Prof. More, "should know not only their customers but their customers' furnaces" and do everything in their power to see that each customer is sold the right coal and knows how to burn that coal efficiently.

Suggestions for improved combustion and elimination of smoke in handling coal in different types of equipment were offered in a symposium presented by fuel engineers of companies affiliated with ACI. T. P. Bateman, Consolidation Coal Co., discussed industrial underfeed stokers from that angle; T. R. Workman, West Virginia Coal & Coke Corporation, pulverizers; L. W. Garver, Leckie Coal Co., residential stokers; William Mittendorf, Holmes-Darst Coal Corporation, industrial and commercial hand-fired furnaces; C. M. Snow, Peabody Coal Co., domestic hand-fired furnaces; E. J. Kerr, Lorain Coal & Dock Coal Sales Co., chain-grate stokers; and F. J. Kasper, Koppers Coal Co., marine problems. Messrs. Kerr and Kasper were unable to be present at the meeting and their papers were read by R. L. Rowan, General Coal Co., and L. A. Shipman, Southern Coal & Coke Co., respectively. Smoke problems encountered with spreader stokers were discussed by J. F. Barkley, supervising engineer, fuel economy service, U. S. Bureau of Mines.

## *Obituary*

EVERETT MCDOWELL HARMAN, 47, president and general manager of the Puritan Coal Corporation, Puritan Mines, W. Va., died Oct. 14 of heart disease at his home in Puritan Mines. He also was a member of the Operators' Association of the Williamson field and was one of the pioneers of the southern West Virginia coal fields.

EDWARD J. MCCOOL, assistant manager of the coal mines of the New River Co., with which he had been connected nearly a score of years, died Oct. 14 of heart disease after an illness of two weeks in a Beckley (W. Va.) hospital.

B. W. PAPE, 41, president and general manager of the Glen Coal Co., died Oct. 13 in a Salt Lake City (Utah) hospital as a result of injuries received in the company's Eagle mine, in Carbon County, several days previous.

THOMAS J. FOSTER, 93, founder of the International Correspondence School, Scranton, Pa., and prominent for many years in the technical coal publishing field, died Oct. 14 in Scranton after a brief illness. In 1887 he acquired the *Mining Herald* and changed its name to the *Colliery Engineer;* nine years later it became *Mines and Minerals,* retaining that name until 1913, when it was changed back to the *Colliery Engineer.* In 1915 it was acquired by and combined with *Coal Age.*

CHARLES L. MOORMAN, 65, mining engineer for the Consolidated Coal Co., with operations in southern Illinois, was killed in an automobile accident early in October near St. Clair, Mo. Blinded by the lights of an approaching car, he lost control of his own car and ran off the road.

# Coal From Seam to Colliery and Furnace Scanned by Coal Division, A.I.M.E.

PITTSBURGH, PA., Oct. 21—Decline and ultimate fall of the Pittsburgh coal bed; the vexed question of family relations between minable coals of Illinois, Indiana and western Kentucky; a new way of estimating the quantity of that "ole davil" fusain, that spoils coke if in excess quantity and often adds materially to ash and sulphur content; the triumphant advance of the duckbill in anthracite mines; improvement of coal by cutting out undesirable seam inclusions; devising a program that will reduce accidents, and the envisioned goal to manufacture a fuel from coal that will "have all the answers" and eliminate defects traveled in cheering, intriguing and discouraging array before the annual meeting of the Coal Division of the American Institute of Mining and Metallurgical Engineers, which opened here today.

That the Pittsburgh coal will not last forever was the plaint of G. H. Ashley, Pennsylvania State geologist (Table I). Dr. Ashley suggested that the average price in the forthcoming years might be $2 per ton, or about 32 billion dollars, making a 39-billion-dollar realization for the entire coal bed. It might, he said, conceivably reach 50 to 60 billions.

Discussing Dr. Ashley's paper, Eugene McAuliffe, president, Union Pacific Coal Co., said that with mechanical loading 90 per cent of available coal was mined instead of 60 per cent, with hand loading, because rooms are driven and pillars drawn in three weeks instead of eighteen months. Too much reserve, he said, would bankrupt a company. His company, he added, had surrendered 26,000 acres of coking coal 80 ft. thick to save 200 years of taxes prior to need. Substantial acreage in Illinois and Utah also had been relinquished. To get big tonnage from a small area, he stated, the company was double-shifting and working six days weekly.

Samuel A. Taylor, consulting engineer, said he had estimated that deep coal in Greene County, Pennsylvania, could meet shafting and other expense only in 4,000-acre blocks and would be profitable only as Connellsville coal was exhausted. In estimating present values for taxation he had figured the dates such blocks would become workable.

Fifty or more different coal seams are present in the Eastern Interior coal basin, but most of them are thin and no single seam is developed over the entire area, declared a paper by J. M. Weller, geologist and head, stratigraphy and paleontology section, Illinois Geological Survey, and H. R. Wanless, assistant professor of geology, University of Illinois. Almost all of them, however, in one or more areas thicken so as to become locally important and to be dug, at least on a small scale, for local use. In Indiana, by stripping methods, some of these thin seams have been mined profitably and on a fairly large scale. Correlations of the principal seams, as stated by the authors, are shown in Table II.

Coal measures were deposited not by hazard but in cyclothems or regular sequences of differentiated rock and mineral beds but these cyclothems are often incomplete because of erosion that carried parts of them away. However, assuming that they must have been complete, allowance can be made for the missing members. Often the coal seam is missing, but enough of the cyclothem remains to give assurance that all of it once was present. Hence, by counting cyclothems, complete or partly eroded, one can be better guided in correlation than is possible when seams of coal alone are counted.

Use of duckbill loaders in the anthracite region was described by F. H. Wagner, vice-president and general manager, Lehigh Valley Coal Co., in a paper abstracted on p. 506 of this issue.

In discussion, Sheldon Jones said mechanical-loading profit lay only in operating concentration and speedy advance under present labor conditions.

Paleobotanic investigation has shown that fusain originated mostly from the wood of gymnosperms [plants with uncovered seeds], especially cordaites [plants or trees with slender stems and heart-

**Table I—Pittsburgh Coal Bed's Past and Future**

| State | Thousands of Tons Mined, End of 1934 | Sales Value in Thousands of Dollars, End of 1934 | Estimated Recoverable Reserves, Thousands of Tons, After Dec. 31, 1934 |
|---|---|---|---|
| Pennsylvania | 3,144,000 | 4,922,000 | 7,500,000 |
| Ohio | 493,391 | 843,699 | 3,000,000 |
| West Virginia | 650,000 | 1,027,000 | 5,500,000 |
| Maryland | 183,224 | 254,681 | 20,000 |
| Total | 4,470,615 | 7,047,380 | 16,020,000 |

**Table II—Correlations of Principal Beds in Eastern Interior Basin, With Areas In Which They Are Found**

| Northern and Western Illinois | Southern and Eastern Illinois | Western Kentucky | Indiana |
|---|---|---|---|
| | | Coal No. 14 | |
| Coal No. 7 | Danville No. 7 | | Coal VII |
| | | Coal No. 12 | |
| Coal No. 6 | Herrin No. 6 | Coal No. 11 | |
| | | | Coal VI |
| Springfield, No. 5 | Grape Creek<br>Harrisburg No. 5 | Coal No. 9 | Petersboro V<br>Linton Block IV |
| Colchester, No. 2 | | | |
| Rock Island, No. 1 | Murphysboro, No. 2 | Mannington | Staunton III<br>Minshall<br>U. Brazil Block<br>L. Brazil Block |

shaped leaves], declared a paper by W. M. Fuchs, A. W. Gauger, C. C. Hsaio and C. C. Wright, Mineral Industries Experiment Station, Pennsylvania State College. Soft fusain usually does not contain more than 10 per cent ash, but hard fusain may contain up to 40 per cent. Ash-forming constituents may consist of infiltrated pyrite, marcasite and phosphates. The structure of the cells is frequently well preserved with their lumens (hollow spaces) usually empty and their walls much thickened. With manual or mechanical separation, the samples usually are contaminated with banded constituents or mineral substances; thus erroneous conclusions as to their characteristics have arisen.

Fusain seems to be amorphous with a specific density reported to vary from 1.5 to 1.6. Electric conductivity and electrostatic capacity is about 5,000 ohms, whereas bituminous coal has a value of 50,000 ohms. Fusain does not melt at the same temperatures as the rest of the coal, hence it still can be recognized even in commercial coke.

Low in volatile, it contains probably only traces of extractable substance. It has more carbon, less oxygen and hydrogen than most bituminous coal, the oxygen not seeming to be combined to form OH, $OCH_3$ or CO groups. Fusain seems to lack double linkages, for it consumes no iodine if subjected to the usual determination. Hydrogen under pressure does not change it, and it is not readily attacked by oxidizing agents. It becomes possible, therefore, to determine the quantity of fusain in any sample chemically, either by hydrogenation under pressure or by oxidation; the two methods check closely. Separation under the microscope, which the authors term "petrographic separation," they declared, was subject to error.

One sample of minus 20-mesh bituminous coal from the Island Creek seam showed 41 per cent fusain by hydrogenation and 41.7 by oxidation; another sample of the same coal showed 27 per cent fusain by the first process and 27.2 by the second. The carbon in fusain on a moisture-ash-and-organic-sulphur-free basis was found to be 93.78 and 94.50 per cent respectively. The relation of coking strength to percentage of fusain as determined by hydrogenation is being studied.

#### How Marketability Was Raised

By changing its cutting practice, one Kanawha mine has reduced the ash content of its coal 3 per cent; another has lowered the ash 4 per cent, said William Reynolds, Jr., engineering department, Goodman Manufacturing Co., describing work done as holder of the A.I.M.E. Mining Machine Manufacturers' Fellowship. A Pocahontas operation has discarded its wet washer, and by making three cuts in its seam is producing a marketable coal. This method of cleaning reduces power and labor for conveying slack to plant, for cleaning slack and for disposal of refuse, increases quantity of cleaned product because less dirt is discarded, prevents the loss of good coal incident to removal of this dirt, reduces labor involved in loading out cleaned coal, saves interest on capital outlay, decreases maintenance costs and depreciation on capital value of plant, renewals, etc., and makes the product of increased value for metallurgical and domestic purposes.

Choice of personnel, crew cooperation and dust control by spraying or vacuum (the latter method not yet satisfactory) are all means of improving the product, urged Mr. Reynolds. A cutting machine with eleven augers, on the same horizontal plane and overlapping one another, has been devised to cut out partings and coal. Dr. T. Matthes has described an instrument which has a swinging hammer with a spherical face that strikes the coal. The angle of rebound indicates the hardness of the coal or impurity struck, and hardness profiles can thus be made of the seam, declared Mr. Reynolds.

Sincere, whole-hearted indorsement of management is the essential element in safety. Attainment of that desideratum, however, is dependent not only on attitude of mind, declared M. J. Ankeny, associate mining engineer, U. S. Bureau of Mines, but on safety education. The nominal head of a safety organization of a large mine with no mines affiliated should be the highest regional official, usually the mine superintendent. If he has no time to attend to all the detail of safety work, he should have a safety engineer who should investigate reportable accidents, sample mine air, and collect and analyze dust samples regularly.

At small mines the local mine management should undertake these duties but at a group of associated mines the general manager or general superintendent should head the safety department, with a safety director handling details. With large companies he should have assistant directors. The safety department should plan and conduct monthly employees' safety meetings, form safety rules to supplement the mine laws, inspect mine properties, investigate accidents, prepare educational programs for workers and supervisory officials, develop new devices, methods and procedure, publicize safety, collect and tabulate accident statistics, formulate safety policies—subject to managerial approval—and make an annual report. Sometimes this organization is supplemented by safety engineers or inspectors employed locally at the mines, who report to the management through the safety department. The local safety director or inspector should not be under the authority of the local mine management, but, except in emergencies, should issue no orders to the local management.

Safety-inspection committees of at least three employees, with a mine official to examine mine and surface plants, have been used to advantage. All personal mine injuries should be investigated—small ones as closely as serious ones—for all are hazards that may cause fatalities. Some companies investigate injuries in which no one is injured. At least one workman should be on the investigating committee, preferably from the same occupation group as the man injured.

#### Differs on Coking Values

That byproducts from coal are immensely valuable is an erroneous belief, declared H. J. Archbald, mining engineer, Scranton, Pa. As a result, the coke product that coal will make generally has been undervalued. Because the profit in low-temperature carbonization lies in the main product and not in the byproducts, a low-volatile coal like Pocahontas will be as desirable for treatment as a high-volatile coal. Any process for the carbonization of coal stands or falls on the value and suitability of the main product: coke or semi-coke.

Bituminous coal has 15 to 20 per cent more heat than anthracite, but the latter nevertheless sells for three to ten times as much as the former because of a preference for anthracite based partly on the fact that it makes no smoke. The heat units which the consumer gets from the coal are those which alone matter and these depend on the manner of combustion, asserted Mr. Archbald. Perhaps anthracite sells for a high price because it burns in a simple manner, whereas bituminous coal has a complex combustion involving absorptions of heat in distillation and in the cracking of its tars. Consumers favor the more effective fuels despite higher cost.

Mr. Archbald defined a good fuel as: (1) smokeless; (2) free-burning; (3) possibly reasonably dense, say between 1.45

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## *Mining Section Leaders*

**C. W. Gibbs, general manager, Harwick Coal & Coke Co., Pittsburgh, Pa., was chosen general chairman of the Mining Section of the National Safety Council for 1936-37 at the annual meeting last month. G. J. Barrett, general claim agent, Oliver Iron Mining Co., Duluth, Minn., was made first vice-chairman; Lee Long, vice-president in charge of operations, Clinchfield Coal Corporation, Dante, Va., second vice-chairman; and A. D. Campbell, McIntyre Porcupine Mines, Ltd., Schumacher, Ont., third vice-chairman. Dan Harrington, chief, health and safety branch, U. S. Bureau of Mines, Washington, D. C., continues as secretary and editor of the news letter.**

**Committee chairmen for the section are: J. W. Alt, safety engineer, Calumet & Hecla Consolidated Copper Co., Calumet, Mich., program; W. G. Metzger, safety director, Hudson Coal Co., Scranton, Pa., entertainment; J. J. Forbes, supervising engineer, safety division, U. S. Bureau of Mines, Pittsburgh, Pa., posters and slides; W. W. Adams, chief, accident-statistics division, U. S. Bureau of Mines, Washington, statistics; M. R. Budd, editor, *Explosives Engineer*, Wilmington, Del., publicity.**

**Committee members-at-large are: Thomas Allen, chief inspector of coal mines for Colorado; P. M. Arthur, American Zinc Co. of Tennessee; F. E. Bedale, Consolidation Coal Co.; J. L. Boardman, Anaconda Copper Mining Co.; L. C. Campbell, Koppers Coal Co.; Morris Coulter, Clearfield Bituminous Coal Corporation; H. T. Harper, Tennessee Copper Co.; H. C. Henrie, Phelps-Dodge Corporation; Rush N. Hosler, Pennsylvania Compensation Rating and Inspection Bureau; Carl F. Keck, Jamison Coal & Coke Co.; Thomas E. Lightfoot, Koppers Coal Co.; D. D. Moffat, Utah Copper Co.; V. O. Murray, Union Pacific Coal Co.; R. B. Paul, New Jersey Zinc Co.; J. T. Ryan, Mine Safety Appliances Co.; L. T. Sicka, St. Joseph Lead Co.; and John Treweek, Homestake Mining C .**

and 1.50 gravity, though what mere heaviness has to do with burning no one knows; (4) possibly containing an ash that prevents clinkering and aids combustion, such as calcium, and in an artificial fuel the ash can be supplemented as desired; (5) strength (a near-coke can be made with 8 per cent volatile matter that will withstand ordinary trucking violence, but for railroad transportation and other abuses a coal of lower volatile content would be required, and such a fuel would not be free-burning).

The need for the compromise between free-combustion and strength in near-coke requires the fuel to be made near the market and could well be left to local retailers. Experiments with Rhode Island anthracite containing 2 per cent volatile and with all kinds of bituminous coal up to 40 per cent volatile all have shown that alone or in mixtures they will make a good product. Lean coals with a low-coking index are the easiest to use. Rich, deep-mined coals have too much volatile matter for straight use and make a weak, puffy, crumbly product. Pocahontas coal makes enough tar, but the tars are too much like pitch and the coal needs more dilution than most coals. Lean, weathered, outcrop coal is better than deep-mined.

The limitations of volatile-matter percentage set up by Mr. Archbald were challenged, it being declared that 16 per cent volatile coke could travel from Pittsburgh, Pa., to Kalamazoo, Mich., without injury, and 1 per cent high-temperature coke gave good combustion. R. Dawson Hall, engineering editor, *Coal Age,* said Mr. Archbald laid overmuch stress on limits he had observed with his own product.

Richard Fenner, consulting engineer, Santiago, Chile, discussed coal mining in a Chilean operation now three miles out to sea from shore with clay roof and floor. The clay, he said, resists the entry of water.

The program for tomorrow includes papers on combustion, ventilation, pillar extraction, shaking-conveyor mining in pitching seams, pillar deformation, mechanical mining of thin anthracite and subsidence, followed by a banquet with addresses. On the following day, members will visit plants at their choice.

## "We Confess an Error"

Through a typographical error, the caption on the perspective drawing of the tipple installation of 1936 appearing on p. 430 of the October issue of *Coal Age* stated that the plant shown was that of the Hardy Coal Co. The caption should have read "Harvey Coal Corporation." This plant of the Harvey Coal Corporation is at Harveyton, Ky., in the Hazard field.

## Colony Company Expands

The Megeath Coal Co. as well as the Central Coal & Coke Co. properties in the Rock Springs (Wyo.) district have been purchased by the Colony Coal Co., according to an announcement by the last-named company. The combined 1935 production of the companies acquired by the Colony concern, which also has an operation at Dines, Wyo., was approximately 190,000 tons.

# Healthy Workers and Anthracite Blasting Emphasized at Safety Council

MINE WORKERS' health as an aid in promoting freedom from accident and occupational disease, better ways of handling explosives, especially in the anthracite region, and means of protecting strip-pit miners from electric shock when in the neighborhood of portable cables featured the addresses and discussion at the meeting of the Mining Section of the National Safety Council held Oct. 6-8 at Atlantic City, N. J.

Under strenuous competition, machinery, equipment, individual tools, haulage, preparation and ventilation have become almost the last word in efficiency and labor-saving accomplishment, but what about the man who digs the minerals or operates mechanical equipment?, asked F. A. Krafft, director of employees' service, Consolidation Coal Co. Does he come to the job as physically fit and efficient as the mechanical equipment or the tools that he uses? Unfortunately, the average industrial worker is only about 75 per cent physically efficient. The missing 25 per cent is largely due to his ignorance of nutrition, prudent purchase, efficient preparation and chemistry of foods, his lack of knowledge of personal hygiene, and of the control and cure of communicable and other diseases. A modern employment program with physical examination, and a medical public health and nursing program alone will break down this ignorance. Analysis of data compiled by 35 mine physicians working on a full-time basis and serving the 60,000 men, women and children in the families of employees of the Consolidation Coal Co. shows that constipation and the common cold constitute 50 to 60 per cent of the ailments treated in the home or in the company's medical units.

As carbon in a gasoline motor reduces its life and efficiency, so do toxins in man destroy his efficiency and productivity, make him subject to accident and perhaps also to those diseases frequently alleged to have an occupational origin. Taking the year as a whole, miners work less than four days per week, and their "Monday morning blues" or their "Monday heads" may be due to their rest periods, for an overtaxed liver and stomach will develop these disorders as readily as will the consumption of liquor, if they consume their customary rations of fuel foods, yet do not exercise themselves enough to convert the foods they eat into physical energy. Athletics of all kinds, gardening, and community outdoor activities in air and sunshine will enable the mine worker to "burn up" whatever he eats or drinks and thus send him back to work unsurfeited with enervating excess food material which will clog his body and mind.

Absenteeism, industrial accidents and subnormal production can be prevented by giving him these opportunities, declared Mr. Krafft. Those who say that this is the worker's own concern miss the dollar value to industry of healthy employees. Correctives of this evil can be provided without paternalism or dictation, the employer interest merely giving good counsel, leaving to the employee the organization, administration, performance and financial support of these activities. Gardens, hog and chicken raising assure higher health standards, particularly in the winter when work is slack, exercise the employee in his spare time, make him less dependent on his employer for scrip or cash advances and stimulate his self-respect and pride.

### Health Necessary for Safety

Well and physically fit men, Mr. Krafft pointed out, are not only good producers but are so mentally alert that head and eyes coordinate with legs and arms and enable a man to mine safely. Safety depends not alone on foolproof appliances, safety instruction and inspiration but on health and energy. That miners are not indifferent to health standards is shown by a survey of 6,000 homes, which revealed that 50 per cent of them had electric refrigerators. If the manufacturers of such equipment can sell them on the benefits of electric refrigeration, why cannot the operator sell them on health conservation? Particularly should they be inculcated in the prevention of epidemics of flu, typhoid, scarlet fever, smallpox and other communicable diseases.

Periodic analysis should be made of milk and water supply both as to impurities and bacteria, and necessary precautions should be taken to assure that both pure milk and water be furnished. All food handlers under company control should be examined twice a year for freedom from communicable diseases. New employees, argued Mr. Krafft, should be examined and periodical examination be made of all old employees. But the company must erect and maintain sanitary toilets, must sanitate them periodically, provide garbage cans, charging only a deposit to assure their return. House roofs and sidewalls must be leakproof and houses kept away from damp ground. Congested tenancy (10 persons in a four-room shack) will tax the ingenuity of the best of doctors and provide hazards for the safety director.

With an average force of 10,000 to 12,000 scattered in communities of from 1,000 to 12,000 persons, the coal company has found it beneficial to itself and men to have public-health nurses of training

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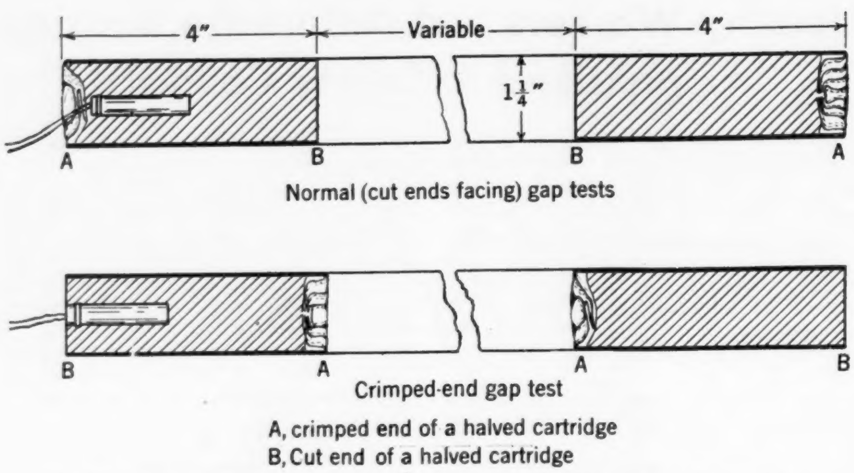
### PERMISSIBLE PLATES ISSUED

THREE approvals of permissible equipment were issued by the U. S. Bureau of Mines in September, as follows:

Goodman Mfg. Co.: Type 824-BJ slabbing machine; 50-hp. motor, 210 volts, d.c.; Approval 268; Sept. 22.

Goodman Mfg. Co.: Type E-10-76 shaker conveyor; 10-hp. motor, 440 volts, a.c.; Approval 207-A; Sept. 3.

Goodman Mfg. Co.: Type G-12½-B-74 shaker conveyor; 10-hp. motor, 500 volts, d.c.; Approval 308-A; Sept. 12.




**Positions of half cartridges with normal-gap, and crimped-end-gap, tests.**

and experience, augmented by public-health training in recognized schools, to teach and provide sanitation, food preparation, bedside and baby care, diet and nutrition, to observe symptoms, to take temperatures and respirations, to use cold, heat and counter irritants, to take care of communicable diseases, to administer first aid in common ailments and emergencies, to hold prenatal, infant, dental, tuberculosis, nose-and-throat, orthopedic and immunization clinics, to examine the health of school children and to instruct them in first aid.

In three-year cycles, the medical service of the Consolidation Coal Co. has for several years immunized 95 per cent of the adult population against typhoid, scarlet fever, smallpox and diphtheria as well as the children, the latter through the local schools. Prior to this in one of the large Kentucky divisions in a population of 10,000, not infrequently were there 200 to 225 cases of typhoid each year with a death rate of 10 to 12 per cent. In the last seven years, with the immunization program in active operation, only fourteen cases of typhoid have had to be treated, these mostly transitory, and is only two cases did death supervene. Epidemics close mines and schools and render the entire population panicky. Nurses and doctors must, however, co-operate to keep the people well.

In West Virginia, Pennsylvania and Kentucky, miners can insure themselves against hospitalization costs by regular contributions of $1.50 to $2 a month. Hospital statistics show, said Mr. Krafft, that 30 per cent of the services are utilized per man employed per year. Over a period of five years practically all the men employed or their families are served by these hospitals, so it is reasonable to assume that, for an investment of about $18 to $24 annually, a miner and his family can be insured against a probable outlay of $100 to $200 a year.

The U. S. Public Health Bureau's survey shows that 25 per cent of the population receives no service of any kind, surgical, medical or otherwise, 79 per cent no service from dentists, 89 per cent no health examination or preventive medical service of any kind and 62 per cent no medical, dental or eye care of any description. If this continues another decade, industry will be manned by misfits and physical unfits, declared Mr. Krafft.

The Consolidation company has found it less expensive to keep men and their families well than to treat them when sick. When its medical program was launched, 90 per cent of its medical doctors were independent practitioners who received their pay from the check-off. To this provision its employees objected, and accordingly a plan was devised by which young graduates of recognized medical schools, after interneships of at least two years, were assigned to the task of keeping the miner and his family well; immediate benefits accrued.

Concurrent physical examination removed those who, because of disease or other infirmities, might become liabilities in accident, compensation or group insurance. At first, 30 to 35 per cent of the applicants had to be rejected, but today the normal rejection is about 22 per cent, and physical status has improved with the more regular employment. Screening out of the unfit starts in the employment office, not in the examination room. Careful questioning as to the employee's condition and record prevent a man from receiving a medical examination if he is not desirable as a permanent employee.

Of 1,000 applicants, 28.5 per cent had no disqualifying physical defects; 48.5 per cent had physical defects which if uncorrected might disqualify them later, and 23 per cent were incapable of performing manual labor. This group was examined by seven different physicians. Rejections ranged from 17 to 27 per cent. The most important disqualifying conditions were defective vision, hernia, developed or potential, imperfect hearts, varicosis, venereal diseases, defective lungs and kidneys, hemorrhoids and old deformities.

A modern 60-bed hospital is maintained fully equipped with X-ray and pathological laboratory to diagnose conditions prior to the performance of any major or minor operation. This laboratory and the medical department have been able to combat the meningitis epidemic better than other Kentucky communities because it has been able in the laboratory to spot the specific germ for the particular type of meningitis involved, so that specific treatment can be administered with invariable cure. Bacteria of tuberculosis, syphilis, typhoid, gonorrhea, meningitis, pneumonia and streptococci infections are isolated. The laboratory prepares autogenous vaccine, matches types and prepares blood for transfusion, compounds cultures and vaccines and weighs and prepares glucose and salines. These preparations have been used with unusual success for eight years.

About seven years ago, group insurance was inaugurated for a nominal monthly premium collected on the payroll. This gives life insurance of not less than $1,000 and not more than $2,000, an accident and health insurance covering occupational and non-occupational incapacitation and paying $12 per week for 13 weeks.

Two of the Consolidation's operating divisions have each about 3,000 employees. The medical set-up and the medical and health problem in each are practically identical. So are mine and house conditions and nationalities. About 80 per cent of the men are native Americans, but one division has twice as much illness as the other. The medical referee of the Equitable Life Assurance Society studied the case, including qualifications of medical personnel and medical facilities, also milk and water supply, and found each group equally well served. However, the hospital records in one case showed that 52 per cent of the operating cases had round or pin worms, particularly where operations were abdominal or intestinal. Stools were studied and thus far 1,000 individuals in 75 per cent of the cases showed parasites—intestinalis, roundworm, pinworm, hookworm, with the last predominating. In the tests 40 per cent of the afflicted persons were found to have hookworm. So the company faces, declared Mr. Krafft, a public health problem.

"Humanics" of industry is as important as mechanics. The industry must conserve and improve the employees' health as ardently as it conserves and improves machinery if it would have lowered costs and lowered accident rates. Costs of the combined program were 0.25c. per ton produced. The safety work cost a mill per ton, declared Mr. Krafft.

### Fancied Progress in Early Days

The last five or ten years, said D. Harrington, U. S. Bureau of Mines, had given some hope of improvement, though in the early days it seemed that the mining industry was "kidding" itself about its safety progress. In the five years 1906-1910 inclusive there were 87 major disasters, or an average of 17 annually, and about 500 killed yearly. In the last five years there have been 19 disasters, about 3 or 4 per year, with about 25 persons killed annually in such major disasters.

Since Sept. 1 of this year, a number of men have been asphyxiated. Even officials do not seem to understand the hazard to which they needlessly expose themselves and are killed. Overlooking the disasters, the industry's safety progress, continued Mr. Harrington, is, however, small. Not much has been done to reduce fatalities from haulage and falls of roof. The explosives hazard has, it is true, been reduced, but the major causes of fatalities remain as destructive as ever. Mechanization introduces hazards. He did not oppose the introduction of machinery, but it must be met with new defenses. In Great Britain, increased mechanization has been the cause, direct or indirect, of almost all the disasters of the last four or five years. Dusty mines result in poorly

lighted mine faces affecting the efficiency of the worker and preventing him from cleaning his coal properly, but nothing has been said of essential lack of safety where such inadequate illumination results, as it must, from dusty air.

In 1934, anthracite mines used about 47 per cent as much explosive as bituminous mines, and their coal production involved only 30 per cent as many man-hours of exposure, yet the underground fatalities in the former mines chargeable directly to explosives were about 71 per cent of those in the latter mines. About 8.6 per cent of the fatalities are charged to explosives in anthracite mines but only 2.4 per cent in bituminous mines, declared S. P. Howell and B. L. Lubelsky, explosives engineers for the U. S. Bureau of Mines and the Philadelphia & Reading Coal & Iron Co., respectively, describing their cooperative field work and laboratory tests, in a paper read by the former.

#### Electric Blasting on Increase

About 65 per cent of anthracite and about 40 per cent of bituminous coal are blasted by permissible explosives and within the last ten years the proportion of shots fired by electric blasting in the anthracite region has been substantially increased. The Bureau of Mines specifies that more than 1½ lb. of permissible explosive should not be used in any shot; it disapproves of dependent shots and, except under abnormal conditions, of firing more than one shot at a time.

Anthracite mines have found it difficult to keep the charge down to 1½ lb., and operators have argued that, as more powder must be used and true permissible conditions cannot be maintained, they might as well use high explosives or even black powder, but the Bureau believes that if "permissible explosives are confined adequately in the borehole and the charge is proportional to the burden, the difference in safety between 1½ lb. and 2 lb. of explosive is, in all probability, not much, if any, greater than the difference in safety between 1 and 1½ lb. of permissible." The safety factor of 1½ lb. of permissible as against black powder is about 45 and, as against dynamite, is at least 17, and these safety factors probably still obtain as against largely increased quantities of permissibles, declared Mr. Howell.

For two years from 1930, the Bureau of Mines and the Reading company have been studying the handling and use of explosives. When the investigation was started, the company had displaced blasting cap and fuse by electric firing. It was also replacing by permissible explosive the 2,800,000 lb. of Judson FF and Judson FFF powder annually used, and now uses no other explosives.

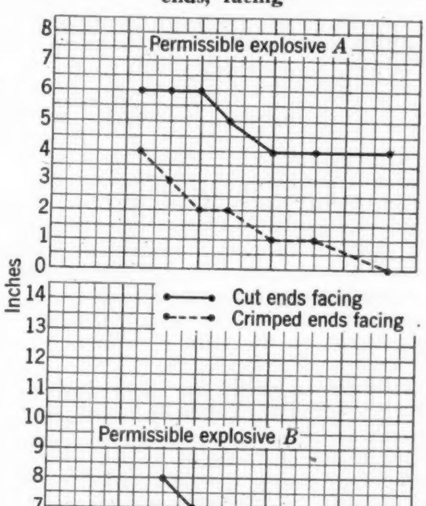
Explosives sometimes burned in the shothole instead of exploding, thus igniting gas. They also possibly were rightly chargeable with starting several small but expensive fires. The explosive burned (1) because, after it had been stored too long in magazines of average mine construction and had been handled and kept underground, it became inadequately sensitive to detonation, or (2) because inert material was allowed to get between the cartridges in charging, thus providing a buffer that prevented effective propagation.

Tests were made to determine the effect of gaps between cartridges which had been stored on the surface for varied periods; in some cases the cartridges were confined in their wrappings and in other cases the jackets were removed and the sticks of explosive cut into halves. The first, or "crimped-end," test is of greatest importance to the consumer; these crimped ends have several folds of paper and are impregnated with paraffin, and, as each cartridge has its crimped end and the ends face each other in the hole, they interfere with detonation. The "halved-cartridge gap" test is of value to the manufacturer in checking his mixes and in the development of new explosives.

Reduction in sensitiveness of the crimped-end cartridges preceded that of the halved cartridge about six weeks. The crimped-end test showed a pronounced fall in sensitiveness of cartridges after three months, whereas the other test showed a slow fall in sensitivity. As a result the Reading company decreed that no explosive should be sent underground that was over three months old as determined by a monthly magazine inventory. Such explosive may be used on a stripping job, where it offers no hazard because of the large-diameter hole and because it is employed usually only in overburden. Some small quantities of relatively insensitive explosives have been destroyed. As a result, the burning of explosives in shotholes has been almost eliminated; gas ignitions from explosives have been more infrequent, and fire hazard has been reduced.

In the standard storage magazine covered with sheet iron and having 4-in. sand-filled walls, the summer temperature may reach 120 deg. F. and the winter temperature may fall to —12 deg. F. The Reading company has had constructed a lean-cement-mortar magazine modeling it after that constructed by the Bureau near Bruceton, Pa. It holds 25,000 lb. of explosive, and after three years is in excellent condition. By a maximum-and-minimum-temperature thermometer, the highest temperature inside in the hot summer of 1936, with outside temperatures exceeding 112 deg. F. in the sun, was found to be 85 deg. F., though the magazine was not shaded. The lowest temperature in the severe winter of 1935-6, with an outside temperature of —24 deg. F., was actually 18 deg. F.

**Relation between age of two explosives and maximum distance, by three trials, at which receiving cartridge will detonate with cut ends, and with crimped ends, facing**




A mix of 1 part cement to 6 parts of coarse sand is used for the cement mortar in walls, sliding door and roof, all three of which will disintegrate to sand in the remote event of an internal explosion. Walls are 6 in. thick, and roof and door 3 in. Bullet- and fire-resistant, the magazine is secured by locks against unlawful entry. Grounded metal covering of No. 26 gage galvanized flat iron partially protects the magazine from lightning, and aluminum bronze paint keeps the temperature low on hot days. Most permissible explosives and many dynamites deteriorate with repeated alternations of heat and cold, possibly because they change from state gamma to beta at about 90 deg. F., and from beta to alpha at about 3 deg. F., each change being accompanied by a contraction, which is 3.4 per cent at the higher temperature. The magazine temperatures during 1936 were well within this range. Two similar magazines are being built by the Reading company.

#### Underground Storage Box Designed

Miners buy explosives by the 25-lb. case and in headings commonly store them with electric blasting caps near by, against or even within the cases of explosives. Headings often were so short that both explosives and electric blasting caps could not be stored at a safe distance from each other. It would seem that the usual regulation has no other purpose than to prevent the more sensitive electric cap, when ignited, accidently or otherwise, from setting off the explosive. Air is an ineffectual barricade. It has been definitely determined by the tests of the authors, said Mr. Howell, that 25 blasting caps effectively arranged will not fire a sensitive dynamite if two 1-in. oak boards, cross-lapped, are placed between the caps and explosive Three 1-in. oak boards will neither be punctured nor split. Such a partition has been incorporated in the design of an explosives box for underground use, explosives and detonators each being placed in their separate compartments.

When several shots are fired at one time, it has been found that at least 0.48 to 1.35 amp. is needed to set off the caps, depending on the kind used. The variation of these minimum currents arises principally from differences in the length of time between the instant when all the bridge wires became hot enough to fire their ignition compound and the instant when the fastest in the series by its explosion broke the circuit, usually by the explosion of the cap, although with high currents the fusing of the bridge wire may ignite the explosive compound. Electric blasting-cap manufacturers recommend a minimum firing current of not less than 1.5 amp., but that gives a greater factor of safety with some caps than with others. Thirty-five elec-

tric blasting caps of one type with iron legs required 0.48 amp. as a minimum, but 25 electric blasting caps of another type with copper legs required 1.35 amp. also as a minimum, using a powerful Schaffler BDX type of multiple-shot blasting machine.

One type of electric blasting cap was found to have a lag of 0.006 second or more when the firing current was 4.25 amp. At lower firing currents the lag was 0.010 second or more.

In front of a face after several shots have been fired concurrently, a lot of crisscrossing wires may be expected to be found, forming what would be a continuous circuit for the shooting current should it still be passing, but possibly not so continuous but that at points of contact or near contact there would be sparking. Such sparking might ignite methane mixtures.

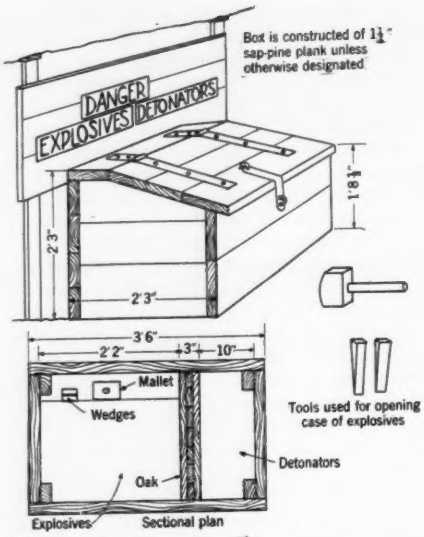
Hence it would be desirable either to develop a suitable dry-cell blasting unit that would not cause a spark of sufficient intensity to ignite gas or to continue to use the 10-shot blasting machines available, arranging, however, that current will last just long enough to assure the complete detonation of every shot in the series but yet will not last so long that it will furnish current after the first detonator has exploded. This can be arranged by a timing switch. By oscillographs, determinations were made showing when the circuit was closed, when it was opened by the timing switch and the times at which the five detonators in series exploded.

### No Misfires With Timing Switch

With one type of detonator now manufactured a timing of 0.005 second on the blasting machine will assure that all the detonators in series will fire, yet none before the timing switch has opened the circuit; other types of detonators may fire 0.001 or 0.005 second before the circuit is disconnected by the timing switch. Twelve of the blasting machines of type stated, having the 0.005 second timing switch, are now in use underground. No misfires have been reported in their use. Six have been retested, and no significant change was found in their timing.

A permanent firing line is established in each working place in the Reading company's mines strung along manway or rib on wood cleats, using two separate lines separated by at least 4 in. A safety break is placed in the line, far enough back from the face that the miner who closes the break cannot be injured if someone actuates the battery prematurely. This break remains open until the last man out of the working place connects it.

Shots to start in motion the coal back of a battery have usually been in the form of clap shots, mud-cap or crevice shots. A blast should not be fired when gas is present, but it is known definitely that the first movement of the blasted mass may draw gas over the shot, which in turn may ignite and cause an explosion or mine fire. Nitroglycerin dynamite is being displaced by ammonia gelatin dynamite for the purpose of avoiding the ready ignition of flammable gas mixtures by the former, the excessive quantities of carbon monoxide it forms on explosion and its excessive sensibility and expense. It is hoped that with sheathed explosives this problem can be met.




**Box in which explosives and detonators might be permitted to be stored together underground**

The Reading company since 1930 has employed electric firing exlusively with all-metal delay electric blasting caps wherever delays are required. Some of the Reading mines have used permissible explosives for many years; the program of making a complete change to permissible explosives started November, 1930, and was completed in 1932. At the beginning of the latter year about 90 per cent of the explosive used in coal blasting was permissible-type explosive, and no nitroglycerin dynamite has been used for chute starting or otherwise since February, 1932.

Discussing the paper, Mr. Lubelsky, said that sometimes the end of a cartridge would be found to have as many as 27 layers of paper, heavily waxed, with air gaps where the paper did not lay up close or where it was separated from the explosive, making it difficult for the detonation to be communicated from cartridge to cartridge. The separation between the compartment in which the detonators were stored and the rest of the box in which the cartridges were placed was a wall of two or three layers of cross-lapped oak, 2 to 3 in. thick. In the test, 25 detonators were placed in the compartment with their ends against the partition so that they would be most effective in their detonative action. The explosive cartridges were similarly arranged. In practice, detonators and cartridges would be thrown in promiscuously, even though each type of explosive would be placed in its own compartment, so the tests were more severe than would occur in use.

Not until the early '20s, when rubber-jacketed high-voltage portable cable substantially in its present form became available, was any real interest shown in the possibilities of using electric shovels in the open iron pits of Minnesota and Michigan, asserted A. C. Butterworth, electrical engineer, Pickands, Mather & Co. Today, in the Lake Superior iron mining district, over fifty shovels and draglines are in operation.

At first, only insulated conductors of the required size to carry the necessary current at the operating voltage were provided, all incased in a suitable jacket. No attention was given to the possibility that a ground return of ample conductivity might be required, but in the comparatively high altitude of certain Western copper mines a sheath of woven copper braid had to be provided over each insulated conductor so as to minimize the corona cutting of the rubber insulation. The earliest cables of rubber-jacketed type for shovel service in the Lake Superior district, purchased about 1925, were of this description.

Advantage was taken of the possibility of using these sheaths as a return, declared Mr. Butterworth; the three braids were combined into one conductor or clamped together by copper clamps and connected to the frame of the shovel at one end of the cable and at the other end to a ground rod or pipe or, in case of a 4,000-volt power circuit, to the ground line itself. Thus a double protection was afforded: (1) a continuous metallic return between "ground" and shovel frame and (2) individual conductors protected by grounded shielding. The cable was thereby safer to handle while carrying power.

Recently a shovel runner was electrocuted when he started to mount the shovel from the ground. Study showed the ground circuits of many apparently high-class cables were of high resistance, that the many supposedly good points of earth grounding were poor, despite large contact areas, and that the soil itself was of low conductivity. The soil readings varied greatly in different mines and districts and in different locations on the same property. Moisture, apparent character of soil, depth of contact points or area of contact were of little value in indicating the probable perfection of the ground; the only sure way of ascertaining ground resistance was by measuring it.

### Proper Shielding Essential

The Lake Superior district still uses the three-conductor rubber-jacketed shielded cable, but one or more supplementary ground conductors have been incorporated in the cable core, according to Mr. Butterworth. Some shovels have reels for paying out the cable as the shovel advances; others have trailing sledges or "stone boats" on which excess cable is carried; others have cable-pulling rings for dragging short lengths of cable behind the shovel, but in many cases excess cable is laid on the ground in long reverse curves by a pit crew and carried forward with the shovel as required. All cables are handled "hot" because the shovels must move under their own power. In one or two instances, long insulated tongs are used, but in practically all cases cables are lifted with bare hands, making a properly shielded cable essential.

If a short-circuit occurs in the cable leading to the shovel motor, the impedance of the latter has little effect; the short-circuit current is limited only by the impedance of the power line itself, which must be kept as low as possible so as to afford a good voltage at the shovel and prevent excessive heating of the conductors; hence these short-circuit currents may easily become great before the protective breaker opens the circuit. That may occur in the fraction of a second, but meantime someone may be electrocuted. In practically every instance, a 4,000-volt distribution system will have a fourth conductor as a ground, in order

to avoid high-resistance earth returns and interference with other electrical system as well as hazard to the employees. Thus impedance will be low and possible "line-to-ground" short-circuit current will be comparable to the "line-to-line" short-circuit current of the 2,300-volt "delta-delta" systems.

Currents of 500 amp. may be expected and even 1,000 amp. in the larger systems, especially if the breakdown occurs near the transformer substation, said Mr. Butterworth. With a ground-fault current of only 500 amp. and a ground resistance of 2 ohms, the voltage drop will be the product of those figures, or 1,000 volts. Thus the shovel frame will have a potential of 1,000 volts during the fraction of a second before the circuit breaker opens, and a person standing on the ground and touching the shovel probably will receive a dangerous or even fatal shock. Even if standing close to the shovel or near the cable, he might receive a dangerous shock through his body from one foot to the other because of the current flowing through the ground. Handling the cable might expose him to a still more severe shock.

Thus a good ground connection is essential. At one property what had been considered a good ground had a resistance of 30 ohms and three extensive ground fields in three different areas on the property had to be developed, interconnected by 9,000 ft. of ground wire. A few system grounds have been developed with a resistance as low as ½ ohm, but most are probably of 1 to 3 ohms resistance, and 5 ohms would be regarded as too high a resistance, though it might not be practicable to improve it.

#### Sheath Wires May Corrode

Excessive sulphur in the rubber-filled tapes of the cables as constructed and also possibly entrance of soil acids through injuries of cable jackets may corrode the sheath wires. Low-reading instruments are sometimes used to reveal much destruction by corrosion, even where ordinary instruments show a continuous return circuit. Knowing the value of the "system-ground" resistance at any property, a test of the resistance from shovel frame to ground will quickly indicate the condition of the ground circuit in the cable.

By inserting a definite impedance in the ground circuit at a safe location, explained Mr. Butterworth, practically the entire voltage from line to ground will be counteracted in forcing the ground-fault current through this device, leaving only a small fraction of the voltage for accidental ground contacts. In the case of the 4,000-volt ground delta-star systems a "current-limiting reactor" can be inserted in the common neutral circuit at the transformer station, so that the secondary system is grounded through this reactor rather than connected directly to ground.

With 2,300-volt delta-delta ungrounded systems, where normally line and ground have no definite point of contact, an accidental line-to-ground fault will not in itself cause any special hazard or interfere with operations, but if such an accidental ground already exists in some other part of the system, as the winding of a compressor or pump motor, and a second breakdown occurs in the shovel cable or on the shovel itself, the second line-to-ground fault would be most likely to occur in a different phase and thus cause a short-circuit of the voltage of the entire system. Thus protection should be sought even against accidental grounds in undergrounded delta-delta systems.

Potential transformers can be so connected that, in such a case, a relay will operate so as to give a warning or open a circuit breaker, but this would indicate only unbalanced voltages occurring simultaneously all over the system, and it would be impossible to determine that a ground fault has occurred, objected Mr. Butterworth. With only one or two shovels operating, this type of protection might suffice; after the relay had tripped out the main circuit breaker, the location of the ground could be determined by test and repairs made, but at some mill operations or pumping stations, such a delay might be too costly or might damage much property. Then, as the shovel cable is the main hazard of the distribution system, the accidental ground should be arranged to trip out the shovel-feeder circuit breaker, leaving the rest of the system operating.

## *Industrial Notes*

Laib Co., 754 South First St., Louisville, Ky., has been appointed by the New York Belting & Packing Co. as distributor of its products in Louisville territory.

Leon H. A. Weaver, formerly publicity manager of the Superheater Co., has accepted a position in the sales and advertising department of the Green Fuel Economizer Co., Inc., Beacon, N. Y.

S. M. Hunter, formerly sales manager of the Novo Engine Co., is now affiliated with the sales department of the American Hoist & Derrick Co., St. Paul, Minn.

Linde Air Products Co., unit of Union Carbide & Carbon Corporation, announces the opening of a new district office at 2 Virginia St., Charleston, W. Va. A. R. O'Neal has been appointed district manager.

C. E. Chatfield has been appointed by the Delta-Star Electric Co., Chicago, as sales representative in Indiana with headquarters at 503 Illinois Building, Indianapolis.

## To Build 146 Coke Ovens

The Koppers Co. has been awarded a contract of $2,000,000 to construct 146 coke ovens at the Fairfield (Ala.) works of the Tennessee Coal, Iron & Railroad Co., a subsidiary of the United States Steel Corporation. Construction will begin at once on the ovens, which will consist of two batteries of 73 each of the new Becker low differential type with self-sealing doors and all modern auxiliaries, having a capacity of 3,200 tons of coal per day.

## Super Highways Urged

Construction of super highways throughout the nation for the "benefit of all classes in all sections for years to come" and thus to find employment for idle men and vitalize industries is proposed by T. E. Steiner, president, Victory Coal Co., Tunnelton, W. Va., and active in other business enterprises. According to the sponsor of the scheme, the building of such highways would enable millions of people to obtain jobs at good pay in the factories producing the materials and tools required in the project. Mr. Steiner advises that the super highways be built, operated and maintained under federal control, independent of the States; as the States through which the roads would be built would receive most of the gasoline tax derived from purchases within their borders, this would enable them to build and maintain existing roads.

## Mine Fatality Rate Climbs

Coal-mine accidents caused the deaths of 85 bituminous and 22 anthracite miners in August last, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With a production of 32,818,000 tons, the bituminous death rate in August was 2.59 per million tons, compared with 2.15 in the preceding month, when 32,054,000 tons was mined, and 2.46 in August, 1935, in mining 25,980,000 tons. The anthracite fatality rate in August last was 6.83, based on an output of 3,223,000 tons, as against 3.55 in the preceding month, when 3,666,000 tons was produced, and 3.86 in August, 1935, when production was 2,591,000 tons. For the two industries combined, the death rate in August last was 2.97, compared with the revised figure of 2.29 in the preceding month and 2.59 in August, 1935.

Comparative fatality rates for the first eight months of 1935 and 1936, by causes, are given in the following table:

FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES, BY CAUSES *

January-August, 1935 and 1936

| | Bituminous | | | | Anthracite | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number killed | | Killed per million tons | | Number killed | | Killed per million tons | | Number killed | | Killed per million tons | |
| Cause | 1935 | 1936 | 1935 | 1936 | 1935 | 1936 | 1935 | 1936 | 1935 | 1936 | 1935 | 1936 |
| Falls of roof and coal. | 324 | 342 | 1.363 | 1.291 | 95 | 92 | 2.732 | 2.695 | 419 | 434 | 1.538 | 1.451 |
| Haulage........... | 131 | 98 | .575 | .370 | 20 | 15 | .575 | .439 | 151 | 113 | .554 | .378 |
| Gas or dust explosions: | | | | | | | | | | | | |
| Local explosions.. | 10 | 14 | .042 | .053 | 7 | 11 | .201 | .322 | 17 | 25 | .062 | .084 |
| Major explosions.. | 9 | 8 | .038 | .030 | 13 | 5 | .374 | .146 | 22 | 13 | .081 | .043 |
| Explosives......... | 22 | 15 | .093 | .057 | 12 | 12 | .345 | .352 | 34 | 27 | .125 | .090 |
| Electricity......... | 25 | 22 | .105 | .083 | 1 | 6 | .029 | .176 | 26 | 28 | .095 | .094 |
| Mining machines.... | 16 | 11 | .067 | .041 | 1 | .... | .029 | ..... | 17 | 11 | .062 | .037 |
| Other machinery.... | .... | 8 | ..... | .030 | .... | 2 | ..... | .059 | .... | 10 | ..... | .034 |
| Miscellaneous: | | | | | | | | | | | | |
| Minor accidents... | 18 | 24 | .076 | .090 | 8 | 14 | .230 | .410 | 26 | 38 | .095 | .127 |
| Major accidents.. | 6 | 9 | .025 | .034 | .... | .... | ..... | ..... | 6 | 9 | .022 | .030 |
| Shaft: | | | | | | | | | | | | |
| Minor accidents... | 6 | 6 | .025 | .023 | 2 | 7 | .058 | .205 | 8 | 13 | .029 | .043 |
| Major accidents... | .... | .... | ..... | ..... | 7 | .... | .201 | ..... | 7 | .... | .026 | ..... |
| Stripping or open cut | 3 | 7 | .013 | .026 | 7 | 4 | .201 | .117 | 10 | 11 | .037 | .037 |
| Surface............ | 25 | 19 | .105 | .072 | 21 | 11 | .604 | .322 | 46 | 30 | .169 | .100 |
| Grand total.... | 595 | 583 | 2.503 | 2.200 | 194 | 179 | 5.579 | 5.243 | 789 | 762 | 2.895 | 2.548 |

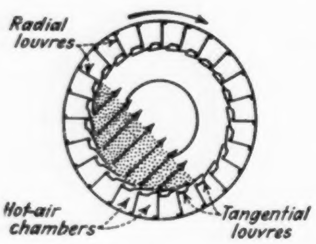
* All figures subject to revision.

# WHAT'S NEW

## *In Coal-Mining Equipment*

### HEAT DRYER

Link-Belt Co., Chicago, has acquired the manufacturing and sales rights for North America for the Dunford & Elliott "rotary louvre dryer" for drying coal, coke and other materials and for other applications. The dryer is described as a mechanically rotated horizontal drum with a series of internal channels near the circumference, into which hot air is admitted from a fan. These channels are covered with tangential plates which overlap in such a way as to leave a gap for the hot air to pass from the channels into the material inside the drum. The channels are tapered to give a gentle slope from the feed to the discharge end.




As the drum revolves, fresh channels come under the charge of material, but, as the inlet is arranged so that heated air is admitted to the channels only when they are directly under the charge, all the gases must pass upward through the bed of material. This combination of dryer design and gentle mixing action, it is stated, causes the hot air to come in intimate contact with every part of the bed, resulting in efficient heat transfer and uniform drying.

### GOGGLE

American Optical Co., Southbridge, Mass., announces the F-3105 "Ful-Vue" goggle which it states has all the comfort and safety features of the regular Ful-Vue goggle (high-up endpieces, self-adjusting nose pads and six-curve "Super Amorplate" lenses) plus side shields that provide extra protection against particles striking from

any direction. The wire-mesh screens, it is said, are non-corrosive and easily cleaned, and the mesh is sufficiently fine to prevent the passage of flying particles and yet does not hinder air circulation. The metal frame also is non-corrosive.

### STRIP TRUCK

Hug Co., Highland, Ill., offers the new Hug Model 30 "Lugger" as a specially designed coal-stripping transportation unit. The Model 30 Lugger is equipped with a four-speed Caterpillar diesel engine with three-speed auxiliary transmission providing a total of twelve speeds forward and three speeds in reverse. Frame and chassis are arc welded, and equipment includes: four-wheel air brakes, air-actuated steering, 13.5x24-in. single front dual rear balloon tires and double-reduction full-floating-type rear axle.

The body is a 10-cu.yd. Hug "scoop-end" unit with a high-angle direct-reversible double-acting hoist. This hoist provides a dumping angle of 78 deg. and thus permits the use of the scoop-end body by assuring complete discharge of the entire load when dumping.

**Model 30 Lugger, Dick Bros. Construction Co., Hazleton, Pa.**

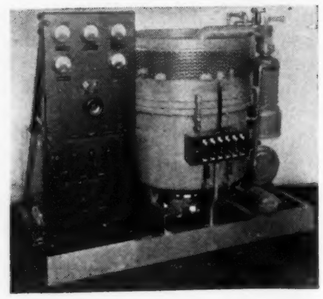
### JACKHAMMERS

Ingersoll-Rand Co., Phillipsburg, N. J., announces the new JA-30 "Jackhammer" for use in place of heavier drills in light rock drilling, such as blockholing, trimming, scaling, drilling holes for conduits, pipe, etc., and in maintenance and demolition work. Fast drilling and economical use of air are pointed out by the company.

Another new Ingersoll-Rand product is the JA-45 "Jackhammer," with which, it is declared, users can get up to a third more drilling from their present compressor equipment. Weight of the unit is 45 lb. Length is approximately 21 in. It is available in wet, dry and blower styles.

### RECTIFIER

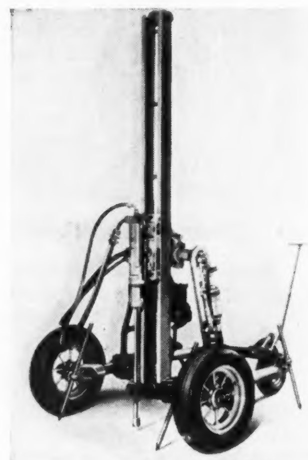
Allis-Chalmers Mfg. Co., Milwaukee, Wis., offers a newly developed low-capacity simplified factory-assembled grid-controlled mercury-arc rectifier unit with a rating of 150 kw. at 250 volts and 300 kw., 550 volts, d.c. This set, it is pointed out, has the rectifier tank, all auxiliaries and the control panel assembled and



wired on a common frame. The set, which stands about 5 ft. high, occupies a floor space of 3½x6 ft. Weight is approximately 3,500 lb.

### DRILLING EQUIPMENT

A new light-weight wagon mounting for fast and powerful rock drills is announced by the Ingersoll-Rand Co., Phillipsburg, N. J. Features cited by the company include: ability to handle 20-ft. steels and accommodate a 6-ft. steel change; great versatility, with positive feed at any angle; air-motor



feed with an indefinite range of pressures from 1 to 1,000 lb.; self-locking worm drive, permitting feeding the drill up to the rock exactly as in hand-cranked drills; and provisions for easier and faster methods of handling the heavier drills, resulting in increased yardage with less operator fatigue. The mounting can be equipped with pneumatic tires for easier movement.

Ingersoll-Rand also offers a new design of aftercooler for use in the discharge line in place of a section of the discharge pipe on air and gas compressors of moderate capacities, thus making the discharge pipe and aftercooler a complete unit. The compressed air or gas passes through a large number of tubes, where it is broken into a number of thin streams to facilitate cooling. Cooling water enters at the point of lowest air temperature and flows counter to the air.

Spaced Bakelite tubes guide the cooling water across the Muntz-metal air tubes. At the end of the "P-L" cooler, air velocity is reduced in a moisture-separating chamber which reverses air flow several times and traps out the condensed moisture. Due to its compactness, says the company, the cooler can be mounted in any position.

Two new "Stopehamers" (SAR 120 and SAR 85) are offered by Ingersoll-Rand, which claims for them greater speed and more power than any previous Stopehamer. Rotation of the drill steel, it is stated, is accomplished through a new design eliminating pawls, pawl springs and ratchets. Also, by controlling air pressure with the throttle, hammer action without rotation is available in collaring holes. Unusually light weight and low air consumption are stressed by the company.

### PUMPING UNITS: COMPRESSORS

Vertical turbine pumps specially designed for dewatering mines, quarries, etc., are a new product of the Worthington Pump & Machinery Corporation, Harrison, N. J. Capacities range up to 10,000 g.p.m., and the pumps may be used as portable sinking pumps to be lowered as the water level recedes or fitted with suitable pipe lengths for fixed installations. Simplicity, compactness, high efficiency,

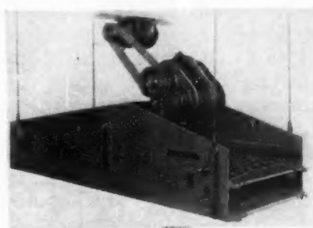
economy and dependable operation are cited by the maker. Rated dynamic heads are 20, 30, 40, 50 and 60 ft. Motor sizes vary from 5 to 250 hp.; speeds from 870 to 1,750 r.p.m.

Worthington also announces "a small, high-quality, low-cost" centrifugal pump with a pressed-steel frame, fewer wearing parts and compact design. Both motor and belt drives are available. Motor sizes range from 1/3 to 3 hp.; capacities from 10 to 130 g.p.m. at heads of 10 to 100 ft.

Three- and six-cylinder vertical-angle two-stage compressors are included in a new line of compact, self-contained units with capacities ranging from 142 to 445 c.f.m. offered by Worthington. The three-cylinder unit has two low-pressure cylinders set opposite each other at an angle with a high-pressure cylinder set vertically between. The six-cylinder unit is set up in the same manner, with two cylinders side by side in each position. Units are available with Worthington "Multi-V-Drive," for direct connection to the motor through a flexible coupling or with the motor mounted directly on the end of the crankshaft.

### VIBRATORS

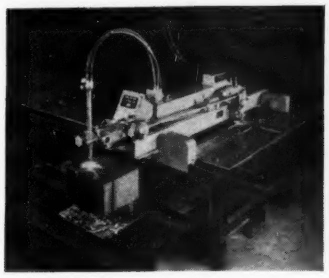
Extension of its line of low-head vibrating screens is announced by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

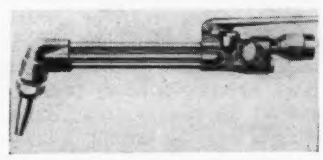


These screens are now available in single-, double- and triple-deck designs in sizes up to and including 6 ft. wide. Minimum headroom and adaptability to installation in existing plants are stressed by the company, together with high capacities in comparatively short lengths.

### WELDING AIDS

Linde Air Products Co., New York City, offers the new "Oxweld" Type CM-12 shape-cutting machine. Ability to cut any shape either by hand or automatic with templets and greater power and cutting capacity than any other machine in its class are claimed by the company. Other features include: automatic cutting of straight lines in any direction and at any bevel; ability to make cuts of as long as 144 in.; special circle-cutting attachment for the automatic production of circles of 4 to 48 in. in diameter; adaptability to multiple cutting by a design per-



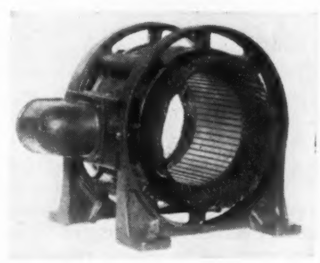


mitting the use of two to five blowpipes performing multiple operations under all the conditions possible with a single blowpipe; speed range of 1½ to 75 in. per minute; and ability to cut material up to 12 in. or, with a special blowpipe, thicker.

Linde also announces a new oxyacetylene cutting attachment (Oxweld Type CW-22) designed to handle material from light sheet metal up to all but the heaviest work at speeds and efficiency equal to those of the full-size cutting blowpipe. The attachment, which can be used on either the Type W-17 or W-22 welding blowpipe handles, operates on either low- or medium-pressure acetylene.

### MOTORS, INSULATION

A new design of riveted-frame squirrel-cage polyphase induction motors in frame sizes from 1 to 15 hp. at 1,800 r.p.m. has been placed on the market by the General Electric Co., Schenectady, N. Y. Coordination of design, the company states, permits the different modifications of motors in the line to be used interchangeably for many types

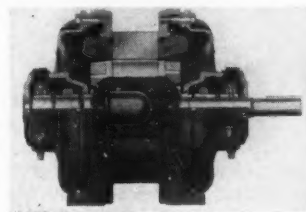


**Standard riveted-frame squirrel-cage polyphase induction motor.**

of power supplies and for various applications requiring open, sleeve- or ball-bearing, inclosed, inclosed fan-cooled, splashproof, vertical, etc., motors. As a result, many special requirements may be met with the standard available line.

Other features of the new line cited by the makers include: "built-from-the-inside-out" insulation for the random-wound stator coil with fused instead of soldered joints at the connections; increased strength and rigidity resulting from the new riveted-frame construction with integrally cast feet; cast-iron end shields of ample strength to maintain accurate bearing alignment and uniform air gap; and a number of convenience features.

The new "built-from-the-inside-out" insulation system is designed for use on the general-purpose line of random-wound squirrel-cage polyphase induction motors of the General Electric Co. With studies showing that the enamel film on the conductor exerts the greatest influence on coil life, various means of improving the quality of this film and better methods of handling the enameled wire during assembly operations have



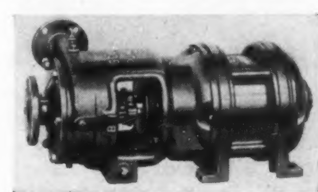
**Wound stator for open polyphase induction motor.**

been incorporated in the new system of insulating the random windings. As a result, an insulation assembly is produced with a high resistance to moisture and other common deleterious influences, such as mild acids, alkalis, oil and abrasion, and the need for taping the end windings is eliminated.

General Electric also offers a new three-shoe spring-set d.c. magnet brake (Type CR9523), which it states combines the mounting flexibility of the two-shoe brake with the braking surface protection of the band-type brake. It is intended for steel-mill and similar machinery and for use where it is necessary to stop and hold a load at the motor armature.

### CENTRIFUGAL PUMPS

For general-service pumping where small space and light weight are essential, Goulds Pumps, Inc., Seneca Falls, N. Y., offers the Figure 3620 line of motor-driven centrifugal pumps in standard and special constructions for handling ordinary and corrosive liquids. Pump and motor are combined in a single unit and fifteen sizes are

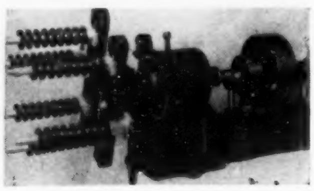


available, providing capacities from 5 to 1,600 g.p.m. All moving parts, it is stated, are mounted on a single oversized shaft running in heavy-duty ball bearings to eliminate friction and wear, assure perfect alignment, eliminate vibration and

permit operation of the pump in any position. Impellers, carefully designed for high pumping efficiency, are of the inclosed single-suction type with safe motor-load characteristics, mechanically and electrically balanced, and are securely keyed and locked to the shaft, the company points out. Casings may be swiveled to any of four positions and are fully equipped with priming and drain openings and air-vent cock.

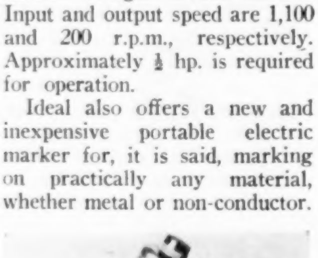
### MAINTENANCE AIDS

Ideal Commutator Dresser Co., 1013 Park Avenue, Sycamore, Ill., offers a new inexpensive coil-winder drive stated to be specially developed for motor repair shops. An important feature noted by the manufacturer is the ease of speed control which enables the operator, by means of a foot-lever control, to adjust the output speed to exactly fit his requirements while the machine is running. This



control performs the functions of starting, stopping, varying speed and braking automatically. The drive, it is stated, can be operated from either a lineshaft or a standard constant-speed motor. Weight is 108 lb. net. Input and output speed are 1,100 and 200 r.p.m., respectively. Approximately ⅛ hp. is required for operation.

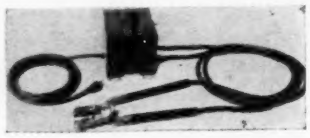
Ideal also offers a new and inexpensive portable electric marker for, it is said, marking on practically any material, whether metal or non-conductor.



Length is 6¾ in. over all; weight is 2 lb. No cabinet, auxiliary controls, rheostats or transformer is required for operation, it is stated. The marker operates on 110-volt 60-cycle a.c. and can be furnished for other standard voltages and frequencies. A hardened point is regularly supplied.

Ideal fuse-clip clamps are another new company product, stated to incorporate a new principle of applying pressure to the blades of fuse or switch clips. A steel clamping ring is forced over the outside of the jaws, exerting a heavy pressure against the fuse or switch clips. This is done by turning a knob. The clamp is said to take an equally firm grip on all clips, regardless of width. A deep insulating skirt is provided.

Ideal also offers the new "Thermo-Grip" pliers, said to take the place of the open-flame blowtorch or burner. When the wire connections are plugged into any 110-volt a.c. lighting circuit, current passes through the transformer and heats the



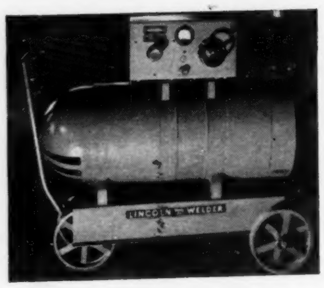
jaws to a white-hot temperature. Weight of the unit complete is 14 lb. It includes renewable carbon jaws, insulated fiber handles and a "Hi-Lo" heat-control switch. Applications include: applying or removing solder lugs, soldered wire connections, stator connections, sweating joints in the new solder-type copper pipe and fittings, etc. A thimble, a pipe cap or a soldering cup can be held between the jaws and the solder melted for soldering pig tails, etc.

### COMPRESSOR

Sullivan Machinery Co., Michigan City, Ind., announces a new heavy-duty air and gas compressor of the single-stage, single-cylinder, double-acting horizontal type in sizes from 10 to 50 hp. and pressures from 5 to 150 lb. per square inch. Features stressed are Timken double-row main bearings, replaceable cylinder liner and crosshead guide, tinned piston and crosshead and streamlined long-life valves, as well as long life, low power cost and fully automatic operation.

### WELDERS

Lincoln Electric Co., Cleveland, Ohio, offers a new line of single-operator arc welders bearing the designation "Shield Arc SAE." The new line supersedes the present 'Shield Arc" equipment, and the predominating feature, according to the company, is a new method of arc control which makes possible the adjustment of both arc heat and arc penetration in a continuous sequence of fine increments, thus assuring absolute uniformity of performance at every control setting. Base and portable parts have been re-



designed for a shorter wheelbase and all the other design points of the "Shield Arc" machines have been retained. The new "Shield Arc SAE" welders are available in the following types and ratings: a.c. motor-driven, 200, 300, 400 and 600 amp.; d.c. motor-driven, 300, 400 and 600 amp.; generator for belt or couple service, 200, 300, 400 and 600 amp.; engine-driven, 200, 300 and 400 amp.

Lincoln Electric also offers the "SA-150" motor-driven single-operator-type arc welder for general fabrication and repair work with a rated current range of 45 to 200 amp. Class B insulation at proper points, the company asserts, permits sustained overloads without injurious effects. Some shops, it is said, are using it with electrodes as heavy as ¼ in. Dual control

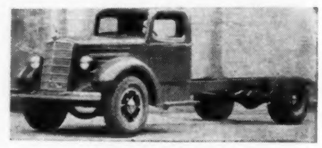

of voltage and current permits independent adjustment of arc heat and penetration to suit the welding application. The new unit is available for 60-cycle power, either 220 or 440 volts, two- or three-phase, in either portable or stationary models. Net weight of the stationary model is 425 lb. Floor space is less than 4 sq.ft.

### SHEET METAL

American Rolling Mill Co., Middletown, Ohio, now offers "Armco" galvanized "Paintgrip" sheets, which it states can be painted by the user without special treatment of the surface. These new sheets, the company asserts, have all the value of full-coated galvanized sheets with the added protection of a special insulating coating which keeps the paint from direct contact with the zinc surface. The result, it is said, is a galvanized metal that has a good physical surface for mechanical adhesion, plus a chemical neutrality that retards the aging of the paint. The Paintgrip treatment is available in any of the grades of galvanized sheets manufactured by Armco, and is supplied in regular and extra-smooth surface finishes. Forming qualities are the same as untreated galvanized sheets with corresponding weights of coating.

### TRUCK

Modern styling is emphasized in the new Model EH truck of Mack Trucks, Inc., New York City, which rates at 18,000 lb. gross and lists at $2,250, f.o.b. Allentown, Pa. Standard wheelbase lengths of 146 and 158 in.



for the truck and 139 in. for the tractor chassis are offered, with optional lengths at extra cost. Gross weight distribution is approximately 30 per cent front and 70 per cent rear. The unit is powered by the six-cylinder Model BG engine developing 79 hp. at a governed speed of 2,300 r.p.m.

### MOTOR-REDUCERS

Philadelphia Gear Works, Philadelphia, Pa., offers two new sizes (Nos. 405 and 444) in its line of totally inclosed fan-cooled "MotoReduceRs" in both the vertical and horizontal types. Both new types are waterproof and dustproof and the No. 444 unit is provided with hollow inner fans through which the air is circulated by the fan. Principal features cited for the design include: better alignment of the pinions and gears, reducing noise and wear; conservation of space; and a balanced strong assembly that, because it has no overhung parts, will not shake itself to pieces. Every part is accessible, says the company, and, when necessary, either the motor or the reduction gears may be removed without disturbing the other.